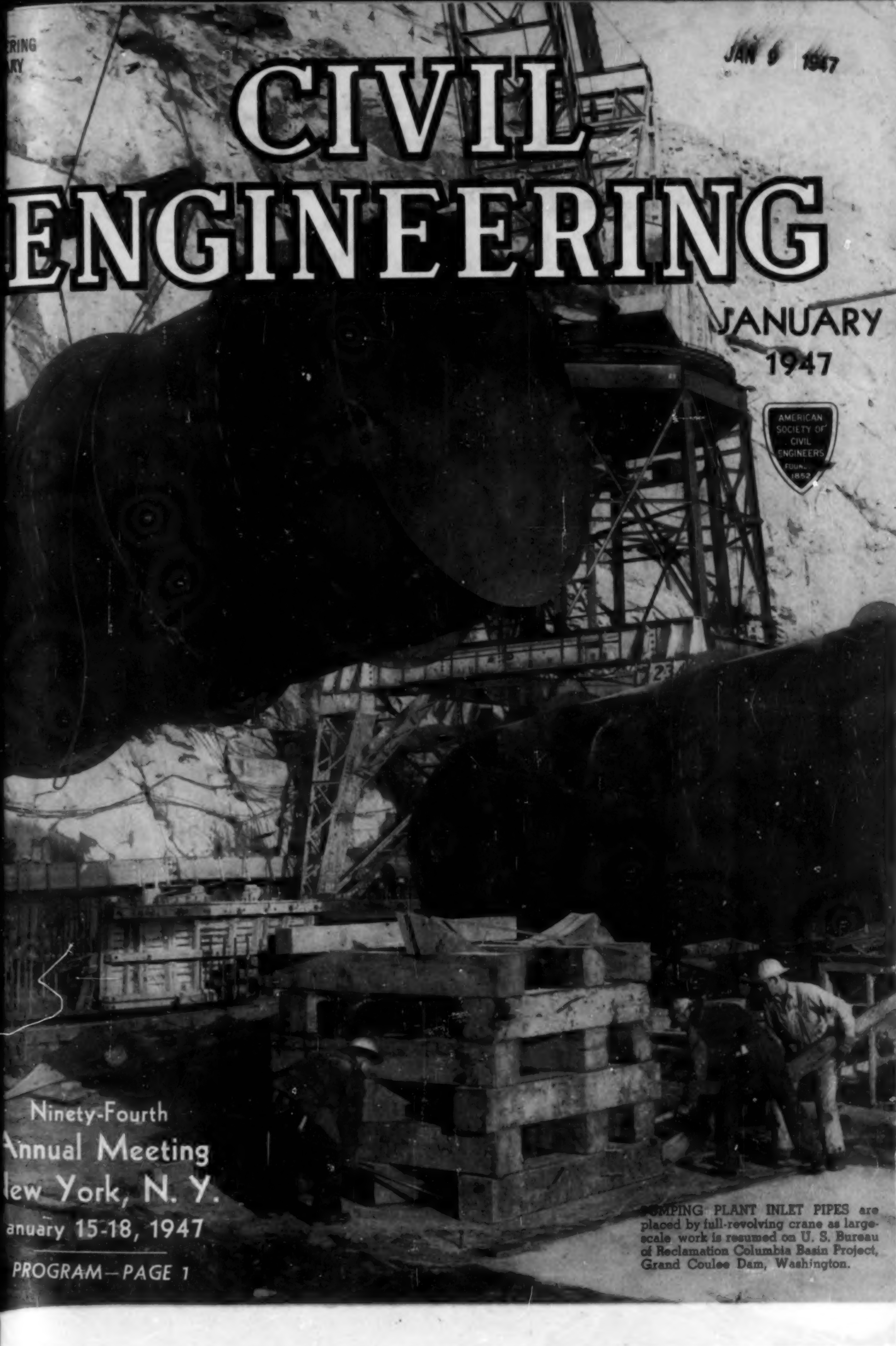
CIVIL ENGINEERING

JANUARY
1947

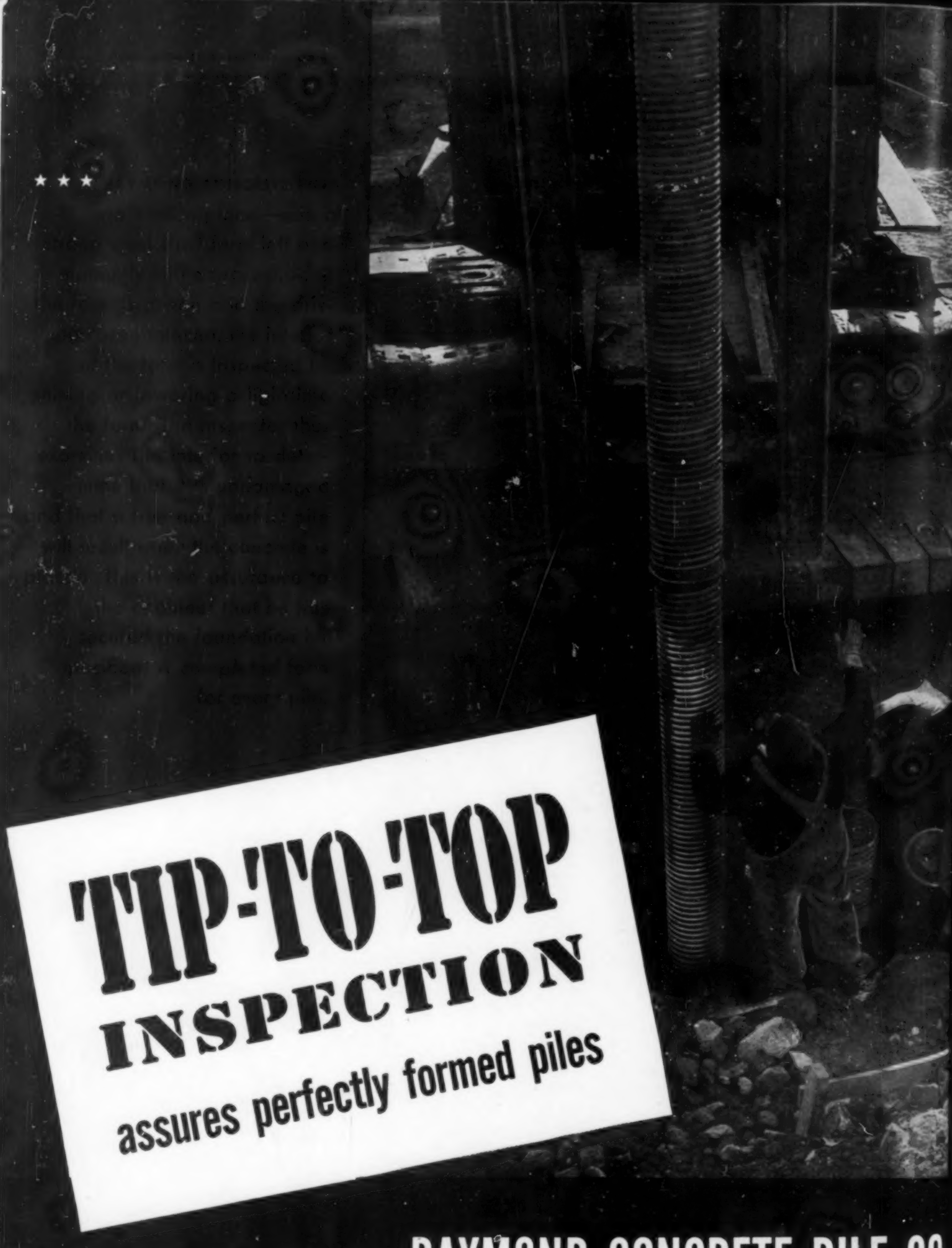
AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852



Ninety-Fourth
Annual Meeting
lew York, N. Y.
anuary 15-18, 1947

PROGRAM—PAGE 1

MPING PLANT INLET PIPES are placed by full-revolving crane as large-scale work is resumed on U. S. Bureau of Reclamation Columbia Basin Project, Grand Coulee Dam, Washington.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JANUARY 1947
Volume 17 Number 1

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

CIVIL ENGINEERING

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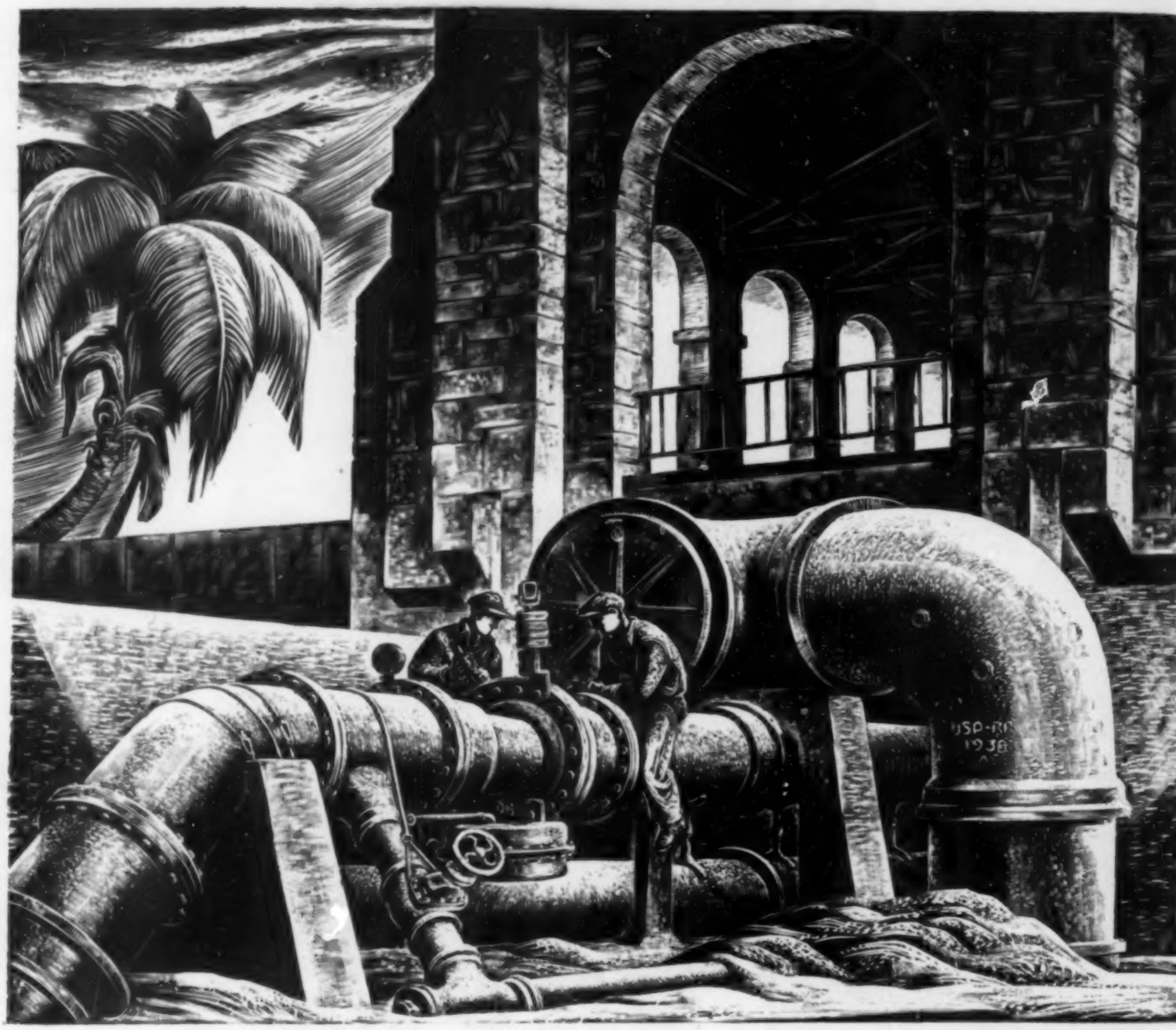

Original Woodcut by Lynd Ward

, No. I

Ninety-Fourth Annual Meeting

Commodore Hotel, New York, N.Y., January 15–18, 1947

Business Meeting, Prize Awards, Conferring of Honorary Memberships

WEDNESDAY—January 15, 1947—Morning

GRAND BALLROOM

9:00 **Registration in Grand Ballroom foyer**

10:00 **Ninety-Fourth Annual Meeting called to order by**

W. W. HORNER, President, American Society of Civil Engineers

Report of the Board of Direction

Report of the Secretary

Report of the Treasurer

10:30 **Presentation of Medals and Prizes**

The Norman Medal to KARL TERZAGHI, M. ASCE, Professor of the Practice of Civil Engineering, Graduate School of Engineering, Harvard University, Cambridge, Mass.; Lecturer and Research Consultant, University of Illinois for paper No. 2253, "Stability and Stiffness of Cellular Cofferdams."

The J. James R. Croes Medal to GAIL A. HATHAWAY, M. ASCE, Special Assistant to the Chief of Engineers, U.S.A., Office of the Chief of Engineers, Washington, D.C., for paper No. 2247B, "Military Airfields—Design of Drainage Facilities."

The Thomas Fitch Rowland Prize to JAMES B. HAYS, M. ASCE, Chief Engineer, Commission of Palestine Surveys, New York, N.Y., for paper No. 2250A, "Unusual Cutoff Problems—Deep Solution Channel, Kentucky Dam, Kentucky."

The James Laurie Prize to L. A. SCHMIDT, JR., M. ASCE, Consulting Engineer, Chattanooga, Tenn., for paper No. 2250B, "Unusual Cutoff Problems—Flowing Water in Underground Channels, Hales Bar Dam, Tennessee."

The Arthur M. Wellington Prize to JAMES H. STRATTON, M. ASCE, Colonel, Corps of Engineers, U.S.A., Supervising Engineer for the Panama Canal, Diablo Heights, Canal Zone, for paper No. 2247A, "Military Airfields—Construction and Design Problems."

The Collingwood Prize for Juniors to C. O. CLARK, Jun. ASCE, Engineer in Charge Hydraulic Section, U.S. Engineer Office, Norfolk, Va., for paper No. 2261, "Storage and the Unit Hydrograph."

10:45 **Presentation of Division Prizes**

The J. C. Stevens Award to JOHN S. MCNOWN, Jun. ASCE, Research Engineer, Iowa Institute of Hydraulic Research; Assistant Professor of Mechanics and Hydraulics, University of Iowa, Iowa City, Iowa, for his discussion of paper No. 2259, "Lock Manifold Experiments."

The Construction Engineering Prize to GEORGE K. LEONARD, M. ASCE, Project Manager, Watauga and South Holston Dams, Tennessee Valley Authority, Elizabethon, Tenn., for his paper, "Lining the Eight-Mile Apalachia Tunnel."

11:00 **Conferring of Honorary Memberships**

ASA W. K. BILLINGS, Hon. M. ASCE, São Paulo Tramway, Light and Power Company, Ltd., Rio de Janeiro, Brazil.
Mr. Billings will be presented to the President by C. P. CONRAD, M. ASCE, President, Iowa-Illinois Gas and Electric Co., Fort Dodge, Iowa.

CHARLES B. BURDICK, Hon. M. ASCE, Consulting Engineer, Chicago, Ill.
Mr. Burdick will be presented to the President by W. W. DEBERARD, M. ASCE, City Engineer of Chicago, Ill.

ALBERT P. GREENSFELDER, Hon. M. ASCE, Chairman, Fruin-Colnon Contracting Co., St. Louis, Mo.
Mr. Greensfelder will be presented to the President by HARRY F. THOMSON, M. ASCE, Vice-President, General Material Co., St. Louis, Mo.

LEROY K. SHERMAN, Hon. M. ASCE, Consulting Engineer, Chicago, Ill.
Mr. Sherman will be presented to the President by GAIL A. HATHAWAY, M. ASCE, Special Assistant to the Chief of Engineers, U.S.A., Office of the Chief of Engineers, Washington, D.C.

11:30 **New Business**

Report of Tellers on Canvass of Ballots for Officers

Introduction of President-Elect and New Officers

11:45 **Adjournment for Luncheon**

Wednesday Luncheon—Grand Ballroom—12:30 p.m.

At the close of the Wednesday morning session there will be a luncheon for members, guests and ladies in the Grand Ballroom of the Hotel Commodore.

Tickets: $3.00 for members and ladies.
3.50 for non-members.
1.00 for students.

SPEAKER: E. O. SHREVE, Vice-President, General Electric Co.

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Sessions of Technical Divisions—Wednesday Afternoon

City Planning Division

WEST BALLROOM

Frank H. Malley, Member, Executive Committee, City Planning Division, Presiding

2:00 Traffic Congestion—What has been done about it in 1946?

WILLIAM J. SHEA, M. ASCE, Chief of Staff, Department of City Planning, New York, N.Y.; Chairman, Executive Committee, City Planning Division, ASCE.

2:30 Cities Can't Live Without Trucks

HOY STEVENS, Chief, Section of Equipment and Maintenance, American Trucking Association, Washington, D.C.

3:00 Business Program for Community Development Pains

NEWTON C. FARR, President, Urban Land Institute; and Chairman, Committee on City Planning and Related Activities, Chamber of Commerce of the United States, Washington, D.C.

3:30 General discussion

Hydraulics Division

EAST BALLROOM

Raymond A. Hill, Chairman, Joint Committee on Design and Operation of Multiple-Purpose Reservoirs, Presiding

Symposium on the Design and Operation of Multiple-Purpose Reservoirs

Arranged by Joint Committee on Design and Operation of Multiple-Purpose Reservoirs

SESSION I

2:00 Introductory remarks

RAYMOND A. HILL, M. ASCE, Chairman, Joint Committee on Design and Operation of Multiple-Purpose Reservoirs; Consulting Engineer, Los Angeles, Calif.

DEVELOPMENT OF GENERAL POLICIES OF FEDERAL AGENCIES

2:00 Multiple-Purpose Reservoirs as Related to Flood Control and Navigation

MALCOLM ELLIOTT, M. ASCE, Colonel, Corps of Engineers, U.S.A. (Retired), Consulting Engineer, St. Louis, Mo.

2:50 Discussion

3:00 The Function of Multiple-Purpose Reservoirs in Conservation Programs

E. B. DEBLER, M. ASCE, Regional Director, U.S. Bureau of Reclamation, Denver, Colo.

3:30 Discussion

3:40 General Design and Operation of Multiple-Purpose Reservoirs

NICHOLLS W. BOWDEN, M. ASCE, Chief, River Control Section, Tennessee Valley Authority, Knoxville, Tenn.

4:10 General discussion

4:30 Adjournment

Sanitary Engineering Division

GRAND BALLROOM

George J. Schroepfer, Chairman, Executive Committee, Sanitary Engineering Division, Presiding

2:30 Introductory remarks

GEORGE J. SCHROEPFER, M. ASCE, Professor of Sanitary Engineering, University of Minnesota, Minneapolis, Minn.

2:35 Report of Committee on Water Supply Engineering

THOMAS H. WIGGIN, M. ASCE, Consulting Engineer, New York, N.Y.

3:05 Discussion

3:15 Final Report of the Committee on Organization, Financing, and Administration of Sanitary Districts

SAMUEL A. GREELEY, M. ASCE, Consulting Engineer, Chicago, Ill., Chairman.

3:30 Discussion

3:35 Final Report of the Joint Committee on Definition of Terms Used in Water Works Practice, covering "A Glossary of Terms Used in Water and Sewer Engineering"

THORNDIKE SAVILLE, M. ASCE, Dean, College of Engineering, New York University, New York, N.Y.

3:55 Discussion

4:05 Progress Report of the Committee on Advancement of Sanitary Engineering

GORDAN M. FAIR, M. ASCE, Professor of Sanitary Engineering, Harvard Graduate School of Engineering, Cambridge, Mass., Chairman

4:15 Discussion

4:20 Organization of an Inter-American Sanitary Engineering Association

EDWARD J. CLEARY, M. ASCE, Executive Editor, *Engineering News-Record*, New York, N.Y.

4:50 Discussion

5:00 Adjournment

Dinner and Dance on Wednesday

GRAND BALLROOM

Committee: Chilton A. Wright, Chairman, Edward J. Cleary, Arthur A. Collard, Nomer Gray

7:00 Assembly 7:45 Dinner 10:00 Dancing

Dinner will be served promptly at 7:45 p.m. Arrangements have been made for tables seating 10 persons and members may underwrite complete tables. Orders to underwrite a table must be accompanied by a check in full and a list of guests.

Tickets will be $7.50 each. Tickets for Juniors, for the Dance only, will be $2.00 per couple.

The seating list for the Dinner-Dance will close at 5:00 p.m., Tuesday, January 14. Those who purchase tickets after that hour will be assigned to tables in order of purchase. Tickets will be on sale at the Registration Desk until 5:00 p.m., Wednesday, January 15.

Student Conference, All Day Wednesday

Program sponsored by the Conference of Metropolitan Student Chapters—Frank Delvers, Chairman

9:00 **Registration in Ballroom Foyer**

10:00 **Opening Session of Annual Meeting—Grand Ballroom**

Student Chapter delegates will join ASCE members in the annual business meeting, awards of honors. For details see page 1.

12:30 **Luncheon**

The Student Luncheon will be combined with the Member Luncheon in the Grand Ballroom. Tickets for Student Chapter delegates are $1.00 each.

2:30 **Student Chapter Conference in Rooms B and C**

Introductory remarks

Francis P. Schaffner, Chairman, Metropolitan Conference Student Chapter Committee

Welcome to student delegates

Frank Delvers, Chairman, Metropolitan Conference of Student Chapters

2:35 **Welcome on behalf of ASCE**

E. M. Hastings, Incoming President, American Society of Civil Engineers

2:45 **Student Chapter Activities**

R. A. Marr, Jr., M. ASCE, Chairman, Committee on Student Chapters, ASCE

2:55 **Expression in Engineering Ideas**

Donald D. King, Assoc. M. ASCE, Editor, Civil Engineering

3:30 **Engineering, and Applied Science**

Dr. John H. Theobald, Assoc. M. ASCE, Dean of Administration, City College of New York, New York, N.Y.

4:00 **Introduction of Delegates and Reports of Chapter Activities**

5:00 **Adjournment**

Students will be welcome to attend all meetings and events of the Annual Meeting

Sessions of Technical Divisions—Thursday Morning

Hydraulics Division

East Ballroom

William G. Hoyt, Chairman, Executive Committee, Hydraulics Division, Presiding

Symposium on Design and Operation of Multiple-Purpose Reservoirs

SESSION II. APPLICATION OF GENERAL POLICIES

9:30 **Multiple-Purpose Reservoirs Used for Flood Control**

Albert L. Cochran, M. ASCE, Hydraulic Engineer, Head of Reservoir Regulation and Hydrology Branch, Office of Chief of Engineers, U.S.A., Washington, D.C.

9:50 **Multiple-Purpose Reservoirs Used for Improvement of Navigation**

R. J. Pafford, Jr., Civil Engineer, Chief of Water Utilization Branch, Missouri River Division, Corps of Enginers, U.S.A., Omaha, Nebr.

10:10 **Multiple-Purpose Reservoirs Used for Irrigation**

Wesley R. Nelson, Regional Director, U.S. Bureau of Reclamation, Amarillo, Tex.

10:30 **General discussion**

RELATIONSHIP OF OTHER AGENCIES

10:45 **Influence of Other Federal Agencies on the Design and Operation of Multiple-Purpose Reservoirs**

1. Federal Power Commission

Col. E. Robert De Luccia, Chief of the Bureau of Power, Federal Power Commission, Washington, D.C.

2. Fish and Wildlife Service

Rudolph Dieffenback, Coordinator of River Basin Studies, Fish and Wildlife Service, Washington, D.C.

3. National Park Service

Conrad L. Wirth, Chief of Lands, National Park Service, Washington, D.C.

4. U.S. Weather Bureau

Merrill Bernard, M. ASCE, Chief, Climatological and Hydrologic Services, U.S. Weather Bureau, Washington, D.C.

11:45 **General discussion**

12:00 **Adjournment**

Sanitary Engineering Division

Grand Ballroom

Prof. Gordan M. Fair, Member, Executive Committee, Sanitary Engineering Division, Presiding

9:30 **Sanitary Engineering Aspects of Housing**

M. Allen Pond, Professor, Yale University School of Medicine, New Haven, Conn.

10:00 **Discussion**

Symposium on Industrial Wastes

10:10 **Effect of Industrial Waste Problems on Stream Pollution Legislation, and Control**

Don E. Bloodgood, Assoc. M. ASCE, Associate Professor of Sanitary Engineering, Purdue University, West Lafayette, Ind.

10:40 **Possibilities of Recovery Utilization**

Dr. F. W. Mohlman, Director of Laboratories, Sanitary District of Chicago, Chicago, Ill.

11:10 **Disposal Methods for Specific Wastes—Synthetic Rubber Plant Liquid Wastes Disposal**

Frank E. DeMartini, M. ASCE, O. R. Placak, and Clarence C. Ruchhoft, Water and Sanitation Investigators, U.S. Public Health Service, Cincinnati, Ohio

11:30 **The Reasons Back of the Kansas State Board of Health Program for the Disposal of Salt Water from Inland Oil Fields**

Ogden S. Jones, Chief Geologist, Oil Field Section, Division of Sanitation, Kansas State Board of Health, Lawrence, Kans.

Members are requested to assist the Committee on Local Arrangements by registering and obtaining tickets to social functions and entertainments as early as possible.

Soil Mechanics and Foundations Division

WEST BALLROOM

Frank A. Marston, Chairman, Executive Committee, Soil Mechanics and Foundations Division, Presiding

10:00 Introductory remarks

WILLIAM H. SMITH, M. ASCE, Rear Admiral (CEC), U.S.N., Director of Planning and Design, Bureau of Yards and Docks, Navy Department, Washington, D.C.

10:15 Large-Scale Model Earth-Pressure Tests on Flexible Bulkheads at Princeton University

GREGORY P. TSCHEBOTARIOFF, M. ASCE, Associate Professor of Civil Engineering, Princeton University, Princeton, N.J.

11:00 Special Features of the Princeton Earth-Pressure Tests

EDWARD R. WARD, Assoc. M. ASCE, Research Associate; JOHN R. BAYLISS and PHILIP P. BROWN, Research Assistants, Soil Mechanics Laboratory, Princeton University, Princeton, N.J.

11:20 Application of Test Results to Bulkhead Design

HARRIS EPSTEIN, Principal Designing Engineer, Bureau of Yards and Docks, Navy Department, Washington, D.C.

11:50 Adjournment

Waterways Division

ROOMS B AND C

Col. C. L. Hall, Chairman, Executive Committee, Waterways Division, Presiding

10:00 Port Terminal Functional Requirements

C. R. DENISON, Assoc. M. (ASCE, Port Engineer, Port Development Division, U.S. Maritime Commission, Washington, D.C.

10:45 Discussion opened by:

JOHN AYER, M. ASCE, Consulting Engineer, Boston, Mass.

CHARLES T. LEEDS, M. ASCE, Major, Corps of Engineers, U.S.A. (Retired), Consulting Engineer, Los Angeles, Calif.

11:10 General discussion

Sessions of Technical Divisions—Thursday Afternoon

Engineering Economics Division

EAST BALLROOM

Jonathan E. Teal, Chairman, Executive Committee, Engineering Economics Division, Presiding

Symposium on Problems of Waterway Clearances Involved in the Crossing of a Water Traffic Route by a Land Traffic Route

Prepared under the direction of the Joint Committee on Waterway Clearances

2:00 Introduction—Brief Statement of the Problem

CHARLES T. LEEDS, M. ASCE, Major, Corps of Engineers, U.S.A. (Retired), Consulting Engineer, Los Angeles, Calif.; Chairman, Joint Committee on Waterway Clearances

2:15 Aspects of the Problem Viewed from the Navigation Standpoint

LOUIS C. SABIN, M. ASCE, Vice-President, Lake Carriers Association, Cleveland, Ohio

2:40 Discussion

2:45 Aspects of Problem Viewed from Highway Traffic Standpoint

J. H. PORTER, M. ASCE, Executiv Officer, U.S. Engineers, Upper Mississippi Valley Division, St. Louis, Mo.

3:10 Discussion

3:15 Aspects of Problem Viewed from Railroad Traffic Standpoint

J. B. AKERS, M. ASCE, Chief Engineer, Southern Railway System, Washington, D.C.

3:40 Discussion

3:45 Aspects of Problem Viewed from Standpoint of Federal Government

RAYMOND A. WHEELER, Lieutenant General, Chief of Engineers, U.S.A., Washington, D.C.

4:10 Discussion

Highway Division

ROOMS B AND C

Day Okes, Chairman, Executive Committee, Highway Division, Presiding

2:00 Evaluation and Coordination of Transportation

JOHN W. WHEELER, M. ASCE, Executive Assistant to the President, Chicago, Burlington and Quincy Railway Co., Chicago, Ill.

2:45 The Need for Construction Education

H. W. RICHARDSON, Assoc. M. ASCE, Executive Editor, *Construction Methods*, New York, N.Y.

3:10 Discussion opened by

FRANK A. NIKIRK, M. ASCE, Engineer, Milton Hale Machinery Co., Albany, N.Y.

3:25 General discussion

Structural Division

GRAND BALLROOM

Alfred Hedefine, Chairman, Executive Committee, Structural Division, Presiding

2:00 A Review of Highway Bridge-Floor Research at University of Illinois

F. E. RICHART, M. ASCE, Research Professor of Engineering Materials, University of Illinois, Urbana, Ill.

2:30 Design of I-Beam Highway Bridges

N. M. NEWMARK, M. ASCE, Research Professor of Civil Engineering, University of Illinois, Urbana, Ill.

3:00 Composite Construction for I-Beam Highway Bridges

C. P. SIESS, Jun. ASCE, Special Research Associate Professor of Theoretical and Applied Mechanics, University of Illinois, Urbana, Ill.

3:30 General discussion

Soil Mechanics and Foundations Division

West Ballroom

Frank A. Marston, Chairman, Executive Committee, Soil Mechanics and Foundations Division, Presiding

2:00 **Some Experiences with Soil Types in Naval Construction**

L. A. Palmer, Senior Engineer, Bureau of Yards and Docks, Navy Department, Washington, D.C.

2:30 **Types of Bulkhead Failures and Their Causes**

John C. Gebhard, M. ASCE, Captain (CEC), U.S.N., Design Manager, and
L. C. Coxe, Commander (CEC) U.S.N., Assistant Design Manager, Bureau of Yards and Docks, Washington, D.C.

3:00 **Discussion of papers of morning and afternoon sessions opened by:**

Donald W. Taylor, Assoc. M. ASCE, Associate Professor, Soil Mechanics, Massachusetts Institute of Technology, Cambridge, Mass.

3:20 **General discussion**

4:30 **Adjournment**

NOTE: Arrangements have been made for a Saturday trip to Princeton University to visit Lateral Earth Pressure and Flexible Bulkhead Research Project.

Trains leave Pennsylvania Station, 9:20 a.m. and 1:01 p.m.

Arrive Princeton, 10:45 a.m. and 2:06 p.m.

Advance registration at Registration Desk is necessary to permit transportation arrangements at Princeton.

Thursday Afternoon Reception, Tea and Fashion Show for Ladies

Hotel Biltmore, Grand Ballroom, 3:00 p.m.

Committee: Herbert Ridgway, Nomer Gray

The Grand Ballroom of the Hotel Biltmore, at 43rd St. and Madison Ave., has been reserved for a Thursday afternoon Reception and Tea for the ladies. The Biltmore may be reached through the main concourse of the Grand Central Station. Reception at 3:00 p.m. Tea will be served at 3:30 p.m.

Following the tea, a fashion show will be sponsored by Franklin Simon, the famous 5th Ave. specialty store. Miss Frances J. Healy, its fashion stylist, will present spring trends of 1947. The showing will include fashions for matrons, women and children, thus appealing to everyone.

With the lifting of limitations, fashions have changed vastly, and there is real news in all phases of milady's wardrobe. Skirts are much fuller, have a greater sweep, and many feature uneven hemlines. Jackets are longer. Sleeves are fuller. The three-piece suit, and dress and jacket ensemble have returned. Fabrics have been perfected greatly during the past few years, and many exciting styles have resulted. A number of new colors have appeared for spring. All these fashions will be discussed by Miss Healy with an eye to the ladies' clothes for the coming season. Tickets $2.00 each.

Dinner-Smoker for Men, Thursday Evening

HotelCommodore, Grand Ballroom

Committee: A. K. Burnham, Chairman, John P. Riley, Ralph W. Atwater

6:30 **Dinner**

8:30 **Entertainment**

The Annual Dinner-Smoker will be held on Thursday evening in the Grand Ballroom of the Commodore Hotel. Dinner will be served promptly at 6:30 p.m. and will be followed at 8:30 p.m. by an interesting program of entertainment.

Ladies Tickets: Because of the anticipated interest of ladies in the entertainment to be provided at the Dinner-Smoker, ladies will be admitted for the entertainment to begin at 8:30 p.m. Ladies' tickets are $1.00 each. These tickets are to be presented at the balcony of the Ballroom at the Commodore between 8:15 p.m. and 8:30 p.m.

Members' tickets $4.00

Guest tickets $5.00

Student tickets $2.00

Sessions of Technical Divisions—Friday Morning

Surveying and Mapping Division

West Ballroom

Philip Kissam, Chairman, Executive Committee, Surveying and Mapping Division, Presiding

Symposium, Aerial Photography in Highway Location

9:30 **1. In the State of New York**

E. T. Gawkins, Deputy Chief Engineer, State Dept. of Public Works, Albany, N.Y.

2. In the State of New Jersey

Spencer Miller, Jr., Commissioner, State Highway Dept., Trenton, N.J.

3. In the State of Connecticut

W. J. Cox, M. ASCE, State Highway Commissioner, Hartford, Conn.

4. In the State of Massachusetts

Elmer C. Houdlette, Director, Survey Division, Department of Public Works, Boston, Mass.

11:00 **General discussion**

Power Division

East Ballroom

Arthur T. Larned, Chairman, Executive Committee, Power Division, Presiding

9:30 **Introductory Remarks**

Arthur T. Larned, M. ASCE, Chief Civil Engineer Ebasco Services, Inc., New York, N.Y.

9:40 **Power and Irrigation in French North Africa—Morocco, Algeria, and Tunisia**

A. V. Karpov, M. ASCE, Consulting Engineer, New York, N.Y.

Discussion opened by

S. Tschaikowsky, French Commercial Assistant Attaché, New York, N.Y.

10:30 **Maintenance of Concrete Structures**

R. W. Spencer, Assoc. M. ASCE, Chief Civil Engineer, Southern California Edison Company, Los Angeles, Calif.

Excursion to Housing Projects—Friday Afternoon

Committee: L. H. Csanyi, Chairman: Arthur A. Collard, Edward J. Cleary, John P. Riley

1:00 Buses will leave the Hotel at 1:00 p.m.

Through the courtesy of the New York City Housing Authority, the Friday afternoon excursion will cover large-scale low-rent housing developments both in the construction and in the completed stages. The first project to be visited will be the Elliott Houses, a 608-family development at 10th Ave. and 27th St., in Manhattan. It was the first of the Authority's developments to go into construction after the war, and is unique in its use of cavity wall construction for buildings as high as 12 stories. It is expected that some of the apartments will be occupied and available for inspection by the date of the excursion, although construction will still be in progress on the remainder of the site.

The excursion will next take members past the sites of the Authority's Lillian Wald and Jacob Riis projects, where work is being started on this 1,800-family project, and past the construction operation of the Metropolitan Life Insurance Co., Sturges, Town and Peter Cooper Housing Development. These public and private housing projects will jointly effect a major change and improvement in the pattern of New York's lower East Side.

Then the group will proceed along the East River Drive to the Authority's East River houses at 105th St. and East River Drive in Manhattan. This 1,170 family project was built in 1940 at the lowest construction cost of any of the Authority's 14 completed projects. Members will have the opportunity of visiting occupied apartments including various facilities such as the Children's Center operated by the New York Kindergarten Society and a baby clinic operated by the Department of Hospitals. From here the excursion party will return to the Commodore Hotel.

NEW YORK CITY Housing Authority's East River Houses at 105th St. and East River Drive, 1,170 family project constructed in 1940, are built at lowest construction cost of any of Authority's 14 completed projects.

United Nations Excursion—Saturday Forenoon

Committee: L. H. Csanyi, Chairman, Arthur A. Collard, Edward J. Cleary, John P. Riley

An excursion has been planned to the Secretariat and Council Chambers of the United Nations at Lake Success, and the United Nations Assembly Hall at Flushing Meadow Park on Long Island for Saturday morning, January 18, 1947.

The Committee has made arrangements to accommodate about 550 members and their guests on this trip. By virtue of facilities at Lake Success, it is necessary that the trip be divided into three groups of about 180 each. Therefore the trip will be made in three sections leaving the Hotel Commodore at 8:30 a.m., 9 a.m. and 9:30 a.m. When making reservations, please indicate which section you desire. If you do not so indicate, or if your reservation is too late for the section requested, tickets will be reserved for you in one of the sections where space is available.

The excursion is deservedly popular, and it is possible that the reservations available may be oversubscribed. Therefore, please make your reservations as early as possible. No tickets will be sold after Friday, January 17, 1947.

DELEGATES TO SECURITY COUNCIL of United Nations meet for first time at Lake Success, Long Island, N. Y. Interpreters are seated at T-shaped table in center of horseshoe.

Official United Nations Photo

College Reunions Throughout the Week

THURSDAY—January 16, 1947

Luncheon of Chi Epsilon Honorary Civil Engineering Fraternity

Members of Chi Epsilon, their families and guests—men and women—will have their 13th annual luncheon at Chin's at 1506 Broadway near 44th St. Luncheon will be served at 12:45 p.m. Service will be a la carte (American or Chinese) and prices will be popular. Make reservations through R. I. Land, % Abraham and Straus Co., 422 Fulton St., Brooklyn, N.Y. (Triangle 5-7200, Ext. 649), or Harold T. Larsen, Room 1610, Engineering Societies Building (Pennsylvania 6-9220, Ext. 123).

Luncheon of Brown University Engineers

A special luncheon to greet visiting Brown engineers will be held at the Hotel Russell, Park Avenue and 37th St., on Thursday January 16, at 12:30. Please notify Sydney Wilmot at Society Headquarters, Pennsylvania 6-9220, or at Convention Headquarters, Commodore Hotel.

University of Illinois Civil Engineering Alumni Dinner

The University of Illinois civil engineering alumni and their friends will meet for the 18th annual informal dinner at 6:30 p.m. on Thursday at the Dinner-Smoker, Commodore Hotel. A private dining room has been reserved on the same floor as the Dinner-Smoker. Dinner-Smoker tickets are $4.00 for members and $5.00 for guests of the Society. All tickets should be ordered from Society Headquarters, and if you wish to join the Illinois group, send your name to Harold T. Larsen (Pennsylvania 6-9220), Room 1610, Engineering Societies Building, New York, or to M. N. Quade, Parsons, Brinkerhoff, Hogan and Macdonald, 142 Maiden Lane, New York, N. Y. (Whitehall 3-0820).

Iowa State College Get-together

Iowa State College civil engineering alumni will meet at the Dinner-Smoker, 6:30 Thursday evening, at the Commodore Hotel. Special tables will be reserved for this informal get-together. Dinner-Smoker tickets: $4.00 for members, $5.00 for guests.

Tickets are to be ordered from Society Headquarters. Those wishing to join this group are asked to send their names to Don King at Society Headquarters.

Luncheon of M.I.T. Engineers

The annual M.I.T. alumni luncheon will be held in the South Room of the Hotel Commodore, on Thursday, January 16, at 12:30 o'clock. Please notify the Technology Club as to attendance (Caledonia 5-7424).

Rutgers University Annual Dinner

Rutgers University civil engineering alumni will meet for their annual dinner at 6:30 p.m. on Thursday at the Dinner-Smoker at the Hotel Commodore. A private dining room has been reserved. Dinner-Smoker tickets are $4.00 for members and $5.00 for non-members of ASCE. Members of the Society should order tickets direct from Society Headquarters, sending their names to C. H. Gronquist, Room 1104, 117 Liberty St., New York, N.Y., if they wish to sit with the Rutgers group. Non-members should order tickets from Mr. Gronquist.

FRIDAY—January 17, 1947

Dartmouth Society of Engineers

The annual meeting and dinner of the Dartmouth Society of Engineers will be held at the Dartmouth Club, 37 East 39th St., New York 16, N.Y., on Friday, January 17, at 6:30 p.m.

Harvard—Yale—Princeton

Joint Annual Meeting of Harvard Engineering Society, Yale Engineering Association, and Princeton Engineering Association will be held Friday, January 17 from 2 to 9:30 p.m., under the auspices of R. H. Macy & Co. Details to be announced later.

SATURDAY—January 18, 1947

Clarkson College Alumni Association

The annual meeting and dinner of the New York Section of the Clarkson College Alumni Association will be held on Saturday evening, January 18, at the University Club, New York, N.Y.

MONDAY—January 20, 1947

Columbia Engineers

The graduates of Columbia University in the field of civil engineering will meet for their 26th informal dinner on Monday, January 20, at the Faculty Club, Columbia University, 117th St. and Morningside Drive at 6:30 p.m. The guest of honor will be George R. Rich, consulting engineer. Mr. Rich was chief design engineer for the Tennessee Valley Authority throughout the major engineering and construction program of that agency. He is now with Chas. T. Main, Inc., of Boston, and is engaged in heavy structural and hydraulic engineering and the appraisal of public utility properties. Mr. Rich will speak on "The Significance of Theory in the Practice of Civil Engineering." The charge of $2.50 per cover will be collected at the dinner. Committee: Robert J. Arnold '39, and J. M. Garrelts '33.

New York University Civil Engineering Alumni

The annual dinner of the New York University civil engineering alumni will be postponed until later in the year, at which time full information will be mailed to the alumni.

Trips to Places of Special Interest in New York

During the Annual Meeting, trips for the ladies to places of special interest in New York will be organized as desired. The following places are listed as suggestions. No special transportation is being provided.

Empire State Building Observation Tower

The Empire State Building is at 34th St. and 5th Ave. The tower is open from 9:45 a.m. to midnight. The charge is $1.20 per person.

Rockefeller Center

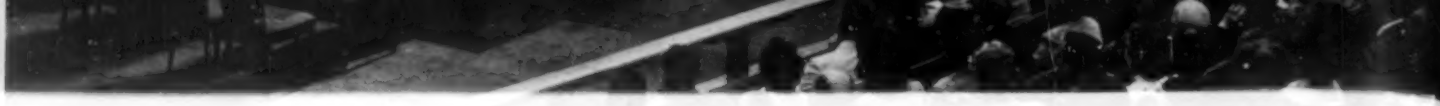
Rockefeller Center, between 5th and 6th Aves. and 48th St. and 51st Sts., contains several places of interest for which regular guided tours are available. Among them is the N.B.C. Studio-Television Tour, which takes groups actually behind the scenes of radio broadcasting and televison. Groups for this tour leave the Studio Section of the R.C.A. Building every 20 minutes from 9 a.m. to 11 p.m. every day in the year, the tour taking one hour and the charge being 70c per person, or 50c per person for groups. Tickets at the 50c rate will be available at the registration desk.

American Museum of Natural History

The American Museum of Natural History is at Central Park West and 79th St. It is open weekdays 10 a.m. to 5 p.m. and admission is free. The 81st St. Station of the Independent Subway has an entrance into the museum. In January there will be a special display of jade and wood carvings.

The Museum of Modern Art

The Museum of Modern Art is at 11 West 53rd St., just west of 5th Ave. The regular admission charge is 30c. A gallery talk and guided tour of the museum starts promptly at 2 and 4:30 p.m. daily. The regular film showings are at 3 and 5:30 p.m. On Wednesday and Thursday, January 15 and 16, two films, "Tatters, A Tale of the Slums" directed by Colby, and "Underworld" di-



rected by Joseph von Sternberg, will be shown. On Friday, January 17, "Chang," photographed by Marian C. Cooper, will be the film.

Metropolitan Museum of Art

The Metropolitan Museum of Art provides a daily program of educational lectures. Special exhibitions through January include Costume Institute of 17th and 18th Centuries; 16th Century Persian Carpets and European Velvets from Samuel H. Kress Collection; Reinstallation of Renaissance Collection, Oriented Arms and Armor, Egyptian Department and Medieval Collection. Admission is free, hours 10 a.m. to 5 p.m. The museum, which is at 82nd St. and 5th Ave., may be reached by 5th Ave. buses Nos. 2, 3 or 4.

The Frick Collection

The Frick Museum includes masterpieces by old and newer painters, rich furnishings, etc., and is on exhibition 10 a.m. to 5 p.m. at 1 East 70th St., just east of 5th Ave., reached by 5th Ave. buses Nos. 2, 3 and 4. Organ recitals are given at 11 a.m., 1:30 and 4 p.m. and there is a regular lecture at 3 p.m. each Wednesday through Saturday. Admission is free.

Museum of the City of New York

The Museum of the City of New York is a historical museum of the city. Of special interest to ladies in January will be the 19th Century Toy Theaters from collection of Alfred Lunt, and the Bertha King Benkard Memorial Early 18th Century Bedroom. A specially conducted tour can be arranged for a group of ladies for a morning or afternoon. The museum is at 5th Ave. and 104th St., and is reached by 5th Ave. buses Nos. 2, 3 or 4.

Cathedral of St. John the Divine

The Cathedral of St. John the Divine is at Amsterdam Ave. between 110th St. and 113th Sts. The Cathedral, which is still under construction (the cornerstone having been laid in 1892), when completed will be the largest Gothic cathedral in the world. It is open to visitors from 7 a.m. to 6 p.m., guided tours being conducted at 11 a.m., 12 noon, 2, 3 and 4 p.m. weekdays. Enter by the 112th St. entrance. The cathedral is reached by 5th Ave. bus No. 4 or by 8th Ave. subway and buses at 110th St. and by Broadway surface car or Broadway subway (1 block west at 110th St.).

St. Patrick's Cathedral

St. Patrick's Cathedral, located on 5th Ave. between 50th and 51st Sts., is open to visitors from 6 a.m. to 10 p.m.

Radio Broadcasts

Tickets for a number of radio broadcasts will be available. These may be obtained at the registration desk.

Good Housekeeping Institute

Good Housekeeping Institute, at 8th Ave. and 57th St., will welcome visitors on Thursday morning, Jan. 16, or Friday morning or afternoon, Jan. 17. Hours are 9 to 12:30 and 1:30 p.m. to 5. The tour takes an hour or more so ladies are requested to allow that period of time before closing time. Group arrangements may be made or ladies may visit individually.

General Announcements

Headquarters Hotel

The Commodore Hotel has been designed as the headquarters for the Annual Meeting. Because of the scarcity of hotel rooms it is important that reservation requests be made as early as possible in advance of departure for New York. The Hotel Commodore has agreed to make a certain number of rooms available. Requests for reservations at the Commodore should state that they are for attendance at the ASCE Annual Meeting and should be addressed to the attention of Mr. William Buckley, public relations. Hotels will mail confirmation of reservations direct to members.

For the benefit of those who may have preference for hotels other than the Commodore, following is a list of rates.

Hotel Rates

Hotel	Single	Double
Ambassador	$6.00 up	$8.00 up
Astor	3.50 up	6.00 up
Barclay	6.00 up	8.00 up
Biltmore	5.50 up	7.50 up
Commodore	3.50 up	5.50 up
Governor Clinton	3.30 up	4.40 up
Lexington	4.00 up	6.00 up
McAlpin	3.30 up	4.95 up
New Yorker	3.85 up	5.50 up
Pennsylvania	3.85 up	5.50 up
Plaza	6.00 up	8.00 up
Roosevelt	4.50 up	6.50 up
Shelton	3.85 up	5.00 up
Taft	3.00 up	5.00 up
Waldorf-Astoria	7.00 up	10.00 up
Wellington	3.00 up	4.00 up
Wentworth	3.00 up	5.00 up
Woodstock	3.00 up	4.00 up

Your New York Address

A file of those in attendance will be maintained at the Registration Desk with information as to members' hotel addresses in New York. Members are requested to keep the Registration Desk informed as to their New York addresses so as to expedite the delivery of telegrams, telephone messages and mail.

Committee on Local Arrangements for the Annual Meeting

Alfred Hedefine, Chairman
M. N. Quade, Vice-Chairman
Lawrence S. Waterbury, Past-Chairman

Irving F. Ashworth, Ralph W. Atwater, A. K. Burnham, Edward J. Cleary, Arthur A. Collard, L. H. Csanyi, Nomer Gray, Herbert Ridgway, John P. Riley, Charles W. Williams, Chilton A. Wright

Junior Members

Bro. B. Austin Barry, Nathan Brenner, Charles A. Knapp, Melville H. Lyman, Jr., Michael Yatsko

Ladies Committee

Mrs. Alfred Hedefine, Chairman

Mrs. Roger W. Armstrong
Mrs. Irving F. Ashworth
Mrs. Ralph W. Atwater
Mrs. Charles W. Bryan, Jr.
Mrs. A. K. Burnham
Mrs. Wm. N. Carey
Mrs. Edward J. Cleary
Mrs. Arthur A. Collard
Mrs. L. H. Csanyi
Mrs. Nomer Gray
Mrs. Shortridge Hardesty
Mrs. Irving V. A. Huie
Mrs. M. N. Quade
Mrs. John P. Riley
Mrs. Thorndike Saville
Mrs. William J. Shea
Mrs. D. B. Steinman
Mrs. Charles E. Trout
Mrs. Lawrence S. Waterbury
Mrs. Harold E. Wessman
Mrs. Charles W. Williams
Mrs. Chilton A. Wright

NEW YORK CITY BUILDING, on site of 1939–1940 World's Fair grounds, is headquarters for United Nations General Assembly.

Official United Nations Photo

Low-Cost Repairs Restore Concrete Hangar To Design Strength

ANTON TEDESKO, M. ASCE

Engineer-Manager, Structural Department,
Roberts and Schaefer Co., Chicago, Ill.

ABILITY OF A Z-D type shell concrete structure to withstand fire and explosion was demonstrated at Wright Field when an Army airplane crashed into a hangar, exploded and set fire to stored airplanes and gasoline. Concrete construction prevented the 2-hour blaze from spreading to adjacent communicating plane-filled hangars. A load test verified the complete restoration of the structure after minor repairs.

MECHANICAL TROUBLE during take-off caused a two-motored Army cargo plane to crash through the door of one of a group of five adjacent concrete hangars of the Z-D shell type at Wright Field, Ohio. The plane exploded and set fire to the well-fueled planes housed in the hangar. High-octane gasoline burned intensely for 2 hours causing temperatures near the hangar roof sufficient to fuse glass portions of the lighting fixtures.

Thin Shell Structure

The affected hangar has a clear span of 160 ft, a clear height of 45 ft to crown, and a length of 212 ft. The five contiguous Z-D-type hangars are separated by walls. A thin roof shell spans between, and is stiffened by, continuous arch frames as shown in Fig. 1. Except in the vicinity where the roof shell slab frames into the supporting arches and edge members, it has a thickness of $3^1/_2$ in. The main supporting arches have a depth of 6 ft 3 in. at the crown. Transverse expansion joints are provided at approximately the third points of the length of the roof.

Edges of the shell at the expansion joints are stiffened by small ribs. Small stiffening ribs also occur halfway between arches in the spans which do not have expansion joints. The supporting arches of adjoining hangars are continuous; the middle hangar of the group of five, however, is isolated by longitudinal expansion joints. End walls consist of a concrete framework covered with asbestos cement board. The 26-ft-high steel-rolling doors are carried on tracks imbedded in concrete foundations. Their top guides are supported by reinforced concrete L-frames suspended from the front arch of the hangar.

Concrete Restricts Blaze

Although a partition wall and temporary end wall were blown out by the explosion, the concrete construction restricted the blaze to the one hangar. Intense heat twisted the steel doors and guides beyond repair. The flames and smoke, rising 300 ft into the air, produced a draft which lifted 10-in. pieces of broken asbestos cement siding from the end wall and dropped them upon the roof. A considerable area of the asphalt roofing was blistered. Notwithstanding these evidences of a ravaging fire, preliminary inspection showed little serious damage to the structure. The decision reached was to repair the hangar by "guniting" and subsequently to make a load test and a complete structural investigation.

Fire Damage Inspected

After the blackened ceiling was cleaned and sand-blasted, a more complete inspection of the roof was possible. Full-depth, transverse cracks in the roof shell extending down either side of the crown for a distance of approximately 50 ft existed in several bays. Approximately 5 percent of the concrete ceiling had spalled. There was also a differential vertical movement between the adjacent ribs of the expansion joint nearest the front of the hangar.

Since inspection revealed no movement of the arch footings or of the longitudinal edge members of the roof slab, and since the compression zone of the arch crown concrete was undamaged, it was concluded that the deflection of the expansion joint ribs was caused by movements in the shell. Since the existing transverse cracks in the shell inhibited its true spatial action, it was concluded that

For the benefit of those who may have preference for hotels other than the Commodore, following is a list of rates.

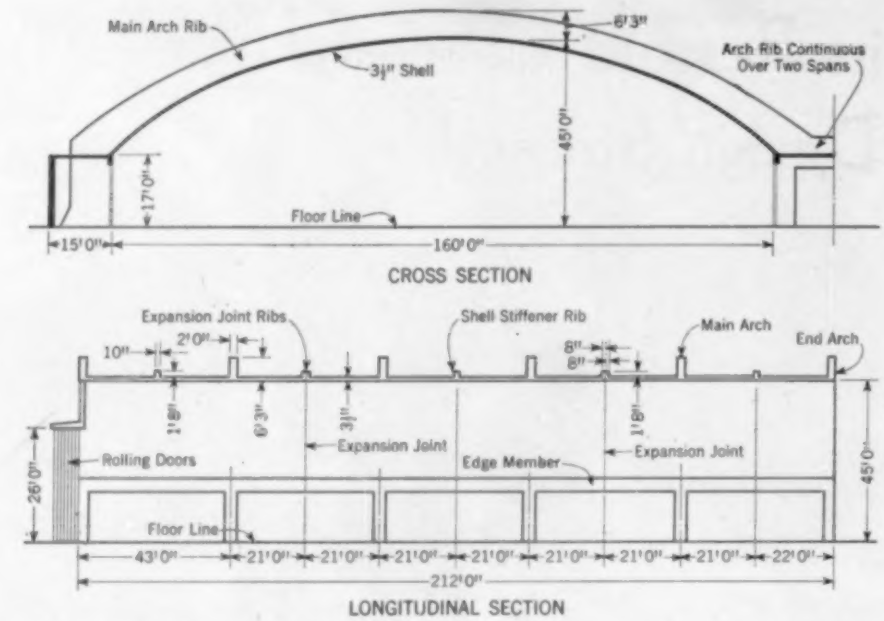


FIG. 1. THIN ROOF SHELL which spans between, and is stiffened by, continuous arch frames has $3^1/_2$-in. thickness except where framed into supporting arches.

a certain degree of arch action had developed in these isolated shell strips. This condition is undesirable since the shell is only $3^1/_2$ in. thick and cannot safely resist the arch moments produced under full design load.

Heat Causes Severe Stresses

Severe forces had to act in the shell to produce the observed damage. The roof slab, subjected to blast pressure and great heat, attempted to expand and elongate. Both the arch and the stiffening ribs restrained the circumferential expansion, producing severe longitudinal moments in the shell in the vicinity where cracks were observed. Calculations showed that a uniform upward pressure of 400 lb per sq ft on the shell would produce moments of sufficient magnitude to cause the steel to yield and the concrete to crack. The same moments could be produced by a temperature differential of 1,100 deg F between the arch and the shell. Some combination of these forces probably existed during the fire to produce the observed damage.

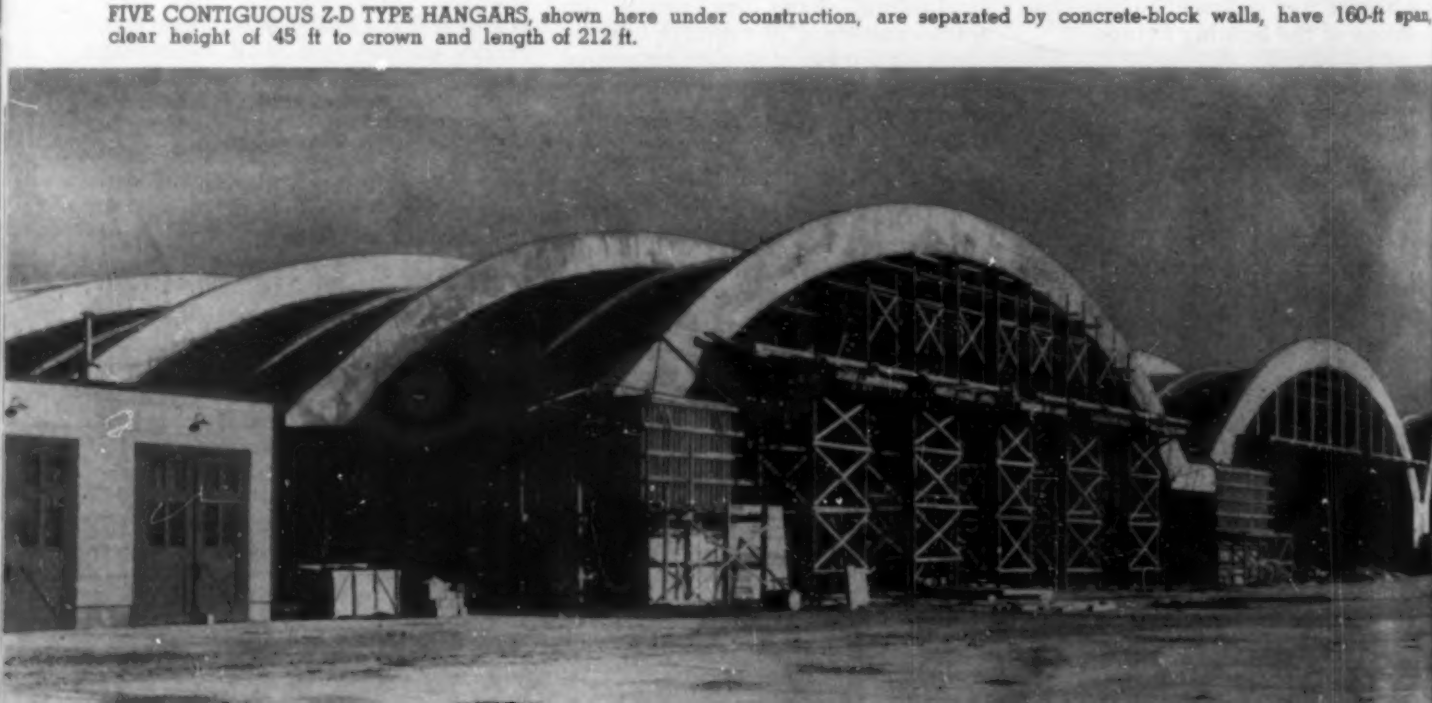
Three major transverse cracks in the shell roof were repaired to restore structural continuity. By restricting the work to alternate 6-ft strips, only one-half the length of each crack was repaired per operation. The cracks were opened and widened, and then reinforced on their under side with welded wire fabric stretched tightly across the exposed area. The damaged area was thoroughly cleaned, wetted, and gunited from below. An anti-shrink admixture was added to the gunite.

Spalled areas in the ceiling were repaired by removing all the unsound concrete, chipping a shoulder at least $^1/_2$ in. deep around the periphery, replacing damaged reinforcing, thoroughly cleaning, wetting, and then finally guniting. To minimize the cost of repairs, no consideration was given to appearance. The repairs were considered satisfactory if they were structurally sufficient.

Field tests established the modulus of elasticity and compressive strength of the old and the repaired concrete, and the effectiveness of the bond between the old and the new concrete. These tests were made by non-destructive dynamic testing technique. The strength of the concrete was obtained as a function of the velocity of a sound wave (initiated in the concrete by a hammer blow) as measured by an electronic interval timer*.

* See *Journal of the American Concrete Institute* for January 1945, "An Instrument and a Technic for Field Determination of the Modulus of Elasticity, and Flexural Strength of Concrete," by Messrs. B. G. Long, H. J. Kurtz and T. A. Sandénaw.

FIVE CONTIGUOUS Z-D TYPE HANGARS, shown here under construction, are separated by concrete-block walls, have 160-ft span, clear height of 45 ft to crown and length of 212 ft.



The purpose of the load test was to determine whether or not the repaired shell could carry the design loads spatially as an undamaged elastic shell, thereby retaining its intended factor of safety. Since the most extensive damage occurred in the front monolith, one panel of this section of the roof was test loaded. The restoration of normal shell behavior depended upon the proper repair of the transverse crack occurring halfway between the first expansion joint of the hangar and the adjacent arch. It was assumed that results obtained by loading this portion of the monolith would be indicative of the behavior of the structure as a whole.

Test Load Applied

A uniform load of 30 lb per sq ft of horizontal projection—equivalent to the original design live load—was applied over the entire test section. A load test was also considered using a greater load in order to establish a minimum factor of safety present in the structure. The decision to use only a 30-lb test load was justified by the following reasoning:

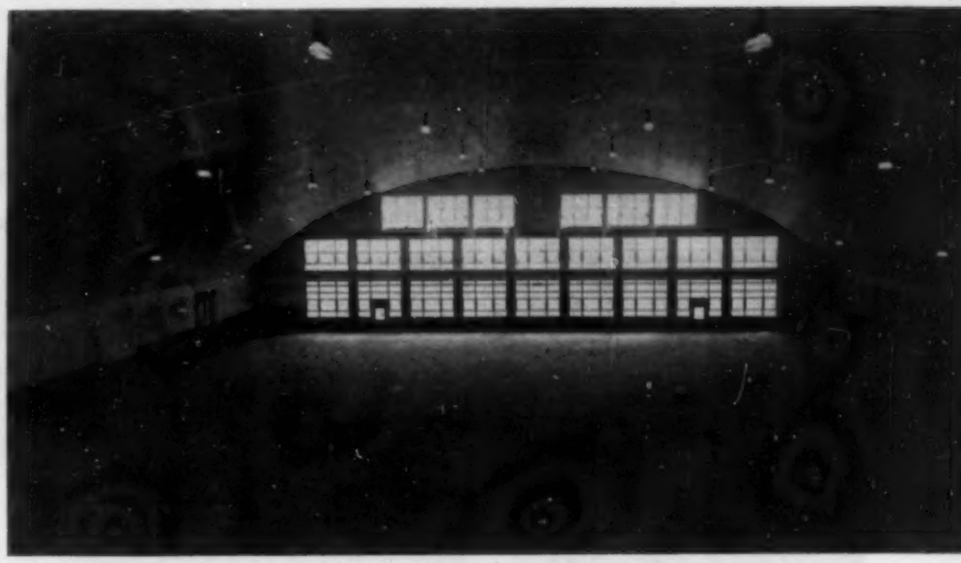
1. Since the arch carries a dead weight of approximately 800,000 lb, and since the test would apply an additional 90,000 lb, it would seem trivial to increase the test load by 50 percent, or even 100 percent, and only increase the total arch load by 5 percent.

2. An estimate of the degree of restoration could be made by comparing the observed deflections of the shell during various load increments with the values computed for an undamaged structure. Observations would indicate continued deflections under full load and permanent deflection upon removal of load. It was more economical to use the minimum practical load applied in four increments with accurate deflection measurements serving as a basis for judgment of the elastic behavior of the structure than to rely upon sheer magnitude of loads with its attendant high cost.

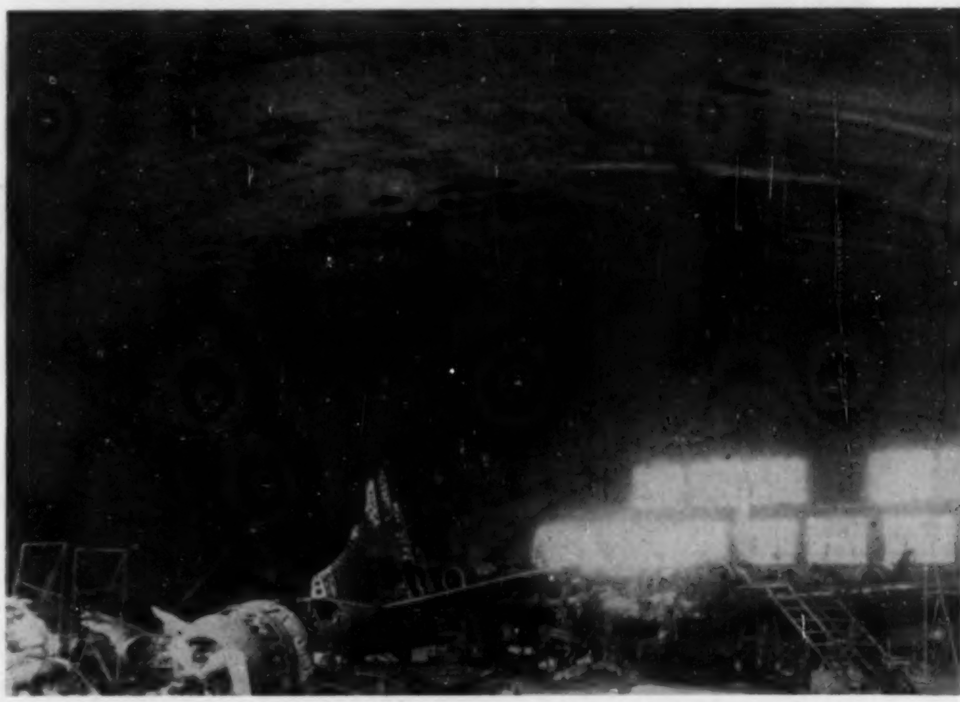
The test load was made up of molded pigs of lead placed in a framework of wood spacers over the test area of the roof to prevent the lead weights from sliding down the curved roof surface, as shown in an accompanying illustration. Arrangements were made to measure the vertical deflections at 16 points.

Methods which called for taking strain-gage measurements to determine the stresses in the roof during the test, and the use of electric resistance methods for the measurement of roof deflections were considered but were discarded for both economic and technical reasons. Weights were suspended from each measuring station on the roof by an 18-gage wire with low expansion coefficient. Deflection readings were taken with a micrometer caliper gage measuring the distance between the hanging weights and steel rods driven into the ground.

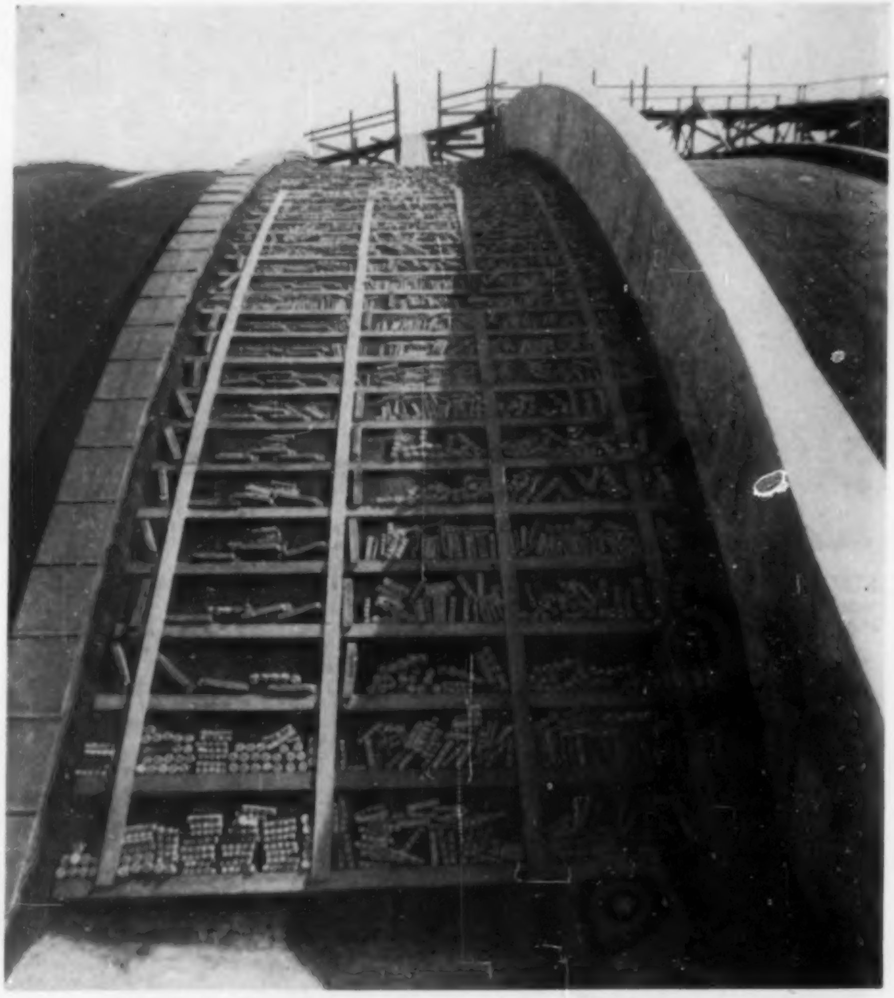
Temperatures were recorded by thermographs located on the roof crown and on the hangar floor. The temperature-correction value for each measuring station was established by taking a series of no-load readings. Deflection readings were taken during the early morning hours following the application or removal of each load increment. By taking the readings at the time the temperature variation was at a minimum, the concrete could assume a temperature more nearly equal to that of the surrounding air. The full load was allowed to



STRUCTURE IS RESTORED TO PRE-FIRE condition (above) and subjected to field tests to establish behavior of repaired structure, modulus of elasticity and compressive strength of old and new concrete.



INTENSE HEAT TWISTS STEEL DOORS and guides beyond repair and fuses glass in light fixtures. Blackened ceiling, approximately 5 percent of which has spalled, is cleaned and sand-blasted before guniting.



TEST LOAD OF MOLDED pigs of lead, held in place by framework of wood spacers, remains in place 3 days while deflection readings are made to determine whether structure moves plastically.

remain in place for 3 days, and deflection readings were made to determine any plastic movement of the structure. The deflection readings of the roof were corrected for temperature effects and represent as nearly as possible the effect of the applied load.

Test Results

Under full load the maximum theoretical deflection of the shell with respect to the main arch rib is 0.061 in. The measured deflection was 0.063 in. The theoretical deflection of the main arch rib at the crown under full load is 0.085 in. as compared with the measured deflection of 0.077 in.

Additional indication of the behavior of the arch was obtained by observing its movements while undergoing temperature changes. The computed vertical deflections of the arch crown for a 1-deg change in air temperature is 0.0076 in. whereas the measured value was 0.0067 in. This is based on the premise that the arch for the range of the test temperature acquired about 42 percent of the air temperature change while the thin shell had acquired the full temperature change.

During the 3-day period in which the full test load of 93,000 lb was allowed to remain on the roof, there was no increase in deflection. Upon removal of the test load the structure returned to its original no-load position.

These results were quite satisfactory and the close agreement between computed deflections and corresponding measured deflections indicated that the structure behaved as a normal elastic shell.

An attempt was made to calculate the stresses and moments in the shell from the measured deflections by use of the differential relationship existing between deflection curves and stress curves. The results of these calculations, however, can only be regarded as qualitative. They indicate the general order and distribution of the stresses. Uncontrollable field influences did not permit the measurement of deflections with sufficient accuracy to make them the basis for a refined analysis.

Conclusions

The concrete repairs were fully successful in restoring the structure so that it can again withstand the forces anticipated and provided for in its original design and construction. The cost of the repairs to the concrete portion of the structure were less than 5 percent of the original cost of the structure.

Had the five hangars and the adjacent research and laboratory facilities been built of frame construction as originally intended, or of unprotected steel construction such as other hangars on the same field, they would have been a complete loss. Aircraft and equipment in the four hangars would also have been lost to a large extent because of the difficulty of wheeling large planes to safety quickly enough to escape a spreading fire and consecutive explosions.

The regrettable accident again demonstrated the amazing performance of reinforced concrete shell structures subjected to fire and explosion.

Acknowledgments

The hangars described herein are operated by the U.S. Army Air Forces Air Materiel Command. They were designed by the Roberts & Schaefer Co. and were built under the direct supervision of the Wright Field district office of the U.S. Engineers—Robert H. Hayes, principal engineer, in charge. Also of Z-D type are the hangars of 298-ft span built for the Navy at San Diego, Calif., which were described by Mr. Tedesco in the article, "Wide-Span Hangars for the U.S. Navy," CIVIL ENGINEERING for December 1941, page 697. Other hangars of this type were described by Robert Zaborowski, Jun. ASCE, and Otto Gruenwald in CIVIL ENGINEERING for August 1944, pages 355–359.

In the test and fire investigation the following collaborated: Roberts & Schaefer Co., Engineers, Chicago, Ill.; U.S. Engineers District Office, Cincinnati, Ohio; U.S. Engineers Office, Wright Field, Ohio; U.S. Engineers Division Office Testing Laboratories, Cincinnati, Ohio; U.S. Army Air Forces, Headquarters; U.S. Army Air Forces, Air Materiel Command.

The illustrations used are official War Department photographs.

Labor Peace, Professional Independence Seen If Employers Are Accredited

FREDERICK H. McDONALD, M. ASCE
Consulting Engineer, Charleston, S.C.

THE LABOR UNIONS have a serious fault in their dealings with employers. If we, as professional men, can avoid that fault, we should be able to eliminate the absorption of engineers into labor unions and the need to organize our own bargaining groups, to escape that absorption.

And why shouldn't we avoid that fault? Is it not the function of engineers to find and to cure the faults of operating procedure?

The fault of the unions is their unwillingness to agree upon standards of performance for employers and employees.

Thus, no matter how well intentioned an employer may be, none can yet feel that he has met the terms of permanent peace with his hired help. He never knows when he has finished bargaining—or when his business will stop or blow up in his face.

I submit that engineers cannot afford to deal that way.

I submit that if we are to hold any shreds of the professional aura we cherish, then we must advance by our brainwork and not by brawn. I submit that if we are to endow our claim of professional ethics with the responsible regard for the interests of those we serve—which is the very essence of a professional status—then we must take the lead in agreeing upon standards of performance—standards which if met by an employer will hold him secure as long as he maintains them. And standards which must be met by employees to hold their rights secure.

How can this be done?

Fortunately, our four Founder Societies embrace the basic classifications for all engineering fields. In them we have the established authority and the financial machinery which already is speaking for, and is striving to maintain, the very professional status we have lately been feeling we can protect only by the self-organization of bargaining groups. Let our societies—singly, in a group, or through a united agency—do this new job for us.

In what way?

Here is one way:

Let us authorize the Engineers Joint Council, or the Engineers Council for Professional Development, or our Society or any combination of societies to act for us. Let them approve the working standards for any employing organization which requests that its engineering jobs be given an accredited status by the engineering profession represented in those jobs. Let all employers of engineers be invited to seek such accrediting—and with its employer obligations, let there be an equal definition of the duties and the obligations of the engineering employees.

This means that a new type of employer would emerge in business—the "accredited employer"—having the approval of the engineering profession on his employment standards for engineers. That is a new concept in a way; but it is not without precedent. For the engineering profession long has exercised the privilege of setting up and maintaining its own standards for the education of engineers—and we have well-recognized and awesome lists of accredited colleges and universities.

Similarly, the legal and medical professions set standards for their institutions—including the courts where lawyers practice and the hospitals where doctors do their work. Can our profession afford to do less for its members?

If you think of any accredited college—as to the status of its reputation, its faculty, salaries, curricula, students and graduates—against those of an unaccredited institution, then you have a vivid parallel of the strength of this new concept of not limiting the standards of engineering performance to academic circles, but of carrying them into professional practice.

This would mean the providing of employing organizations with certificates of accredited status on the duties, the salaries and the working conditions for all technical positions. If this be done, the needs of the individual engineer will be amply met. He will be a free man, with no need to join any bargaining group, though he would join a society to establish his status in an independent and ethical profession.

Are we not already groping with one element of this procedure in our careful studies and recommendations for minimum salaries—with nothing to trade or to make them attractive for adoption by employers—and no control by the right of professional approval or disapproval?

That control would meet the objections of the thousands of engineers who are now perplexed because they fear the need for organizing, but have been unable to act independently because they cannot condone the unprofessional aspects of any form of bargaining which implies a resort to force. Yet this very failure to act independently is subjecting some of them daily to automatic absorption in labor unions. With professional controls, no union or bargaining group would have any claim on the engineer to join or to be included in its jurisdiction.

I see no conflict in this plan with our Society's policy of encouraging the organization of local bargaining groups of engineers. So far, this has seemed the best procedure—and the fact that we may now be finding a way that looks more palatable for professional men is no more of a reflection on what we are doing than the discovery of electric lights was on gas lights. The essential thing is to recognize improvement when it comes—but not to discard what we have until the new proves its advantages. Hence, we must continue to encourage our bargaining groups and to gain every inch we can until this—or any better—substitute is established and working. But once in gear, this plan should knock bargaining out of the picture for engineering employees. Instead, we would have "accredited employment standards" as gaged by the profession itself—against which rock the unions and the regulatory agencies would crash in vain.

Nor do I see any reason why this procedure would not be well within the powers of our engineering societies. I grant the problem is large in scope. But it presents no great difficulties in its approaches, its organization or its details. The benefits to employers can be made evident enough to attract their desire to be accredited, voluntarily; and I can see adequate methods of setting up the procedure, financing it and mak-

(*Continued on page 56*)

Davis Dam Completes Storage Regulation of Colorado River Below Boulder

L. R. DOUGLASS, M. ASCE

Assistant Regional Director, Region III, Bureau of Reclamation,
U.S. Department of the Interior, Washington, D.C.

ENGINEERING INITIATIVE and large-scale construction techniques have succeeded in taming the Colorado, once one of the world's wildest rivers. Dams have been built at the Boulder, Parker, Imperial, Laguna, and Headgate Rock sites for the regulation of the river, diversion of irrigation and domestic water supply, and in the case of Boulder and Parker for the production of hydroelectric power. The addition of Davis Dam will complete the plan for the development of the river below Boulder Dam.

LARGEST UNDERTAKING by the Bureau of Reclamation on the Colorado River since Boulder Dam is the Davis Dam project, now under construction. Its main purposes are three: River reregulation; servicing of the treaty between the United States and Mexico, which provides for the division of the waters of the Colorado and Tiajuana rivers and of the Rio Grande between the two countries; and generation of electrical energy to augment the power supply in the Southwest. The site of the dam and power plant is in Pyramid Canyon, 34 miles by improved highway from Kingman, Ariz., the railhead, and some 67 miles downstream from Boulder Dam.

Work Is in Initial Stages

Construction of the Davis project is progressing according to schedule. Plans provide for an earth and rock-fill dam, together with appurtenant structures, including a 225,000-kw hydroelectric power plant; and for approximately 900 miles of power transmission lines with associated substations and facilities. Present activities consist mainly of installation of contractor's plant, construction of both the government and contractor's camps for the housing of construction forces, and excavation of the channel for diverting the river around the dam site.

By river reregulation is meant refining of the general plan of control of the river's flow. Boulder Dam is operated in such a manner that the firm-power production of the power plant can be coordinated with the output of plants in Southern California, its principal market area, to meet the load requirements in that locality. At certain periods the resulting reservoir releases from Lake Mead are not ideally suited to meet the irrigation requirements of the areas now irrigated and those potentially irrigable below Boulder Dam. The quantity of water passed through the turbines at Boulder is in excess of the current demand for irrigation water and this excess escapes unused to the Gulf of California. Davis Reservoir will make possible regulation of these discharges from Boulder to conform more closely with downstream requirements.

The Mexican Water Treaty, ratified and placed in force on November 7, 1945, calls for apportioning of Colorado River water between that country and the United States. Davis Dam will serve a second important function in providing the degree of control needed to meter out the water in accordance with that agreement. The United States obligated itself under the treaty to construct Davis Dam within five years from the time of ratification.

And finally, the project utilizes the last substantial head in the river below Boulder Dam suitable for power production. It will generate

PYRAMID CANYON, 67 miles below Boulder Dam, is the site of Davis Dam and appurtenant structures here indicated. Placing of Boulder Dam determined approximate location of Davis project for further control and regulation of the river.

from 800 million to 1 billion kwhr annually to supply requirements in the Southwest.

Named After an Engineer

Plans for the building of Davis Dam crystallized several years ago when the project was authorized by Congress under the general provisions of the Reclamation Act. The project was then called "Bulls Head" after a rock formation at the head of Pyramid Canyon which, when viewed downstream from across the river, might with appropriate imagination on the part of the observer be considered to resemble a bull's head in shape. The project was more appropriately renamed "Davis" in 1941 in honor of the late Arthur Powell Davis, a Past-President of ASCE who, as one of the original builders of the old Reclamation Service beginning with its inception in 1902, and later as director of the Service from 1914 to 1923, laid the foundation for the planned development of the Colorado River.

The building of Boulder Dam approximately located the point where an additional dam could be constructed for further control and regulation of the river. At the selected site in Pyramid Canyon the river fill is composed of sand, gravel, and silt to a maximum depth of 200 ft above bedrock. This foundation is adequate for an earth and rock-fill dam with provision of a deep cutoff trench across the river section and suitable cutoff walls along the abutments. The river reregulation made possible by Lake Mead permits the safe and economical utilization of this type of structure.

A contract for construction of the dam was awarded in June 1942 to the Utah Construction Co. The field activities of the contractor began early in August of the same year, but the work was halted in December after the War Production Board revoked the priority ratings required to obtain the necessary materials for construction.

Soon after the collapse of Germany in 1945 the Bureau again received the green light to proceed with the building of Davis Dam. Bids for a new labor contract were opened in Kingman on December 21, 1945, and the Utah Construction Co. again submitted the low bid, about $22,000,000. The new contract was awarded in January and notice to proceed was given in March 1946. The contractor began to move in men, equipment, and materials almost immediately after notice of the award of the contract was given. The initial excavation for the diversion channel of about 100,000 cu yd, completed under the original contract, gives the present contractor a running start in his race against the 1,200 days of contract time allowed him to complete the project.

EXCAVATION FOR SEWAGE DISPOSAL plant for "Davis City," new town to house workers, is handled by Caterpillar D-7 tractor-dozer and D-7 with La Plant-Choate Carryall.

Releases from Lake Mead, above Boulder Dam, are not expected to exceed a maximum of 60,000 cfs. The diversion channel being excavated through the Arizona abutment will provide for passing this quantity of water around the dam site. This channel will be utilized as a permanent feature since it is designed for use as the power-plant forebay, spillway channel, and outlet for non-power water releases. Temporary cofferdams will be constructed upstream and downstream from the dam site to permit unwatering of the site and preparation of the foundation.

Dam to Be Earth and Rock Fill

A zoned, rolled-earth and rock-fill embankment will form the dam proper, 1,600 ft long and 138 ft high above the river bed. The crest, at El. 655 ft above sea level, will have a width of 50 ft to provide for a two-lane roadway; the base width at the maximum section will be approximately 1,400 ft. The dam will create a reservoir with a capacity of 1,820,000 acre-ft at a normal water-surface elevation of 645.0, corresponding to the tailwater elevation at Boulder Dam.

The central or impervious zone of the dam and cutoff trench backfill will consist of selected clay, sand, and gravel moistened and rolled in 6-in. compacted layers. A blanket of the same material will extend from the dam axis over the entire upstream part of the foundation. The zones immediately upstream and downstream from the central impervious portion will be of semipervious rock screenings, moistened and rolled in 12-in. compacted layers with a blanket of the same material over the downstream part of the foundation.

The upstream face of the embankment will have a layer of dumped rock riprap of increasing thickness from top to bottom, with an outer slope of 1 on 3 terminating at a 40-ft-wide berm at El. 575. Beyond the berm this riprap becomes a rock fill with an outer slope of 1 on 8 to provide a stabilizing weight for the upstream impervious blanket.

The downstream rock fill, also of increasing thickness from the crest downward, will have an outer slope of 1 on $2^1/_2$ to El. 575 and beyond that point a slope of 1 on 12 terminating at the grade of the power-house access road at El. 556; then a slope of 1 on 3 below this elevation to intersection with the river bed. This heavy rock fill provides a stabilizing weight for the downstream part of the embankment and foundation.

The cutoff trench in the river-bed section of the embankment will be located with its center line parallel to, and 75 ft upstream from, the dam axis. It will be excavated to such depth as required by the character of the foundation materials, will have a bottom width of 120 ft, side slopes of 2 on 1 and, as previously noted, a compacted backfill of the same materials as those composing the impervious zone of the embankment. A concrete cutoff wall, projecting a maximum of 15 ft into the impervious portion of the fill and a minimum depth of 3 ft into the underlying rock foundation, will be constructed along each abutment. Grout curtains will be provided below these abutment cutoff walls.

Diversion and Forebay Channel

Through the left abutment will pass the diversion and forebay channel, approximately 4,500 ft long. The upstream or strictly diversion section will have a bottom width of 200 ft. At the downstream end this width is increased to provide the power-plant forebay. The channel will be concrete lined for a distance of 1,070 ft

upstream from the combined spillway and outlet structure.

On the right side of the forebay will be the power-plant intake, a gravity-section structure of mass concrete enclosing five 22-ft-dia welded-plate-steel penstocks leading to the power-plant turbines. Trash racks will be provided at the penstock inlets, and flow control will be by fixed wheel gates operated by hydraulic hoists. A 125-ton gantry crane will be set up on the crest of the intake structure for erection of gates and hoists and their later handling for operation and maintenance.

Adjoining the power-plant intake structure at the downstream limit of the forebay will be the spillway, containing the outlets for non-power water releases. The spillway will be gate controlled, with an ogee or overflow section. Three 50 × 50-ft fixed wheel gates will be installed on the crest and operated by vertical lift hoists placed in an overhead housing. Two outlets, one on each side of the spillway structures, each controlled by a 22 × 19-ft, high-head, hoist-operated radial gate, will allow reservoir withdrawals other than those through the power plant.

Construction Items and Quantities

Major items involved in the construction of the dam and power plant, and quantities, are as follows:

Excavation of earth and rock	5,530,000 cu yd
Earth and rock fill in dam embankment	3,800,000 cu yd
Concrete in dam, spillway, power plant, and structures	455,000 cu yd
Reinforcement bars in concrete	15,500,000 lb
Gates and hoists	4,900,000 lb
Other metal work	7,400,000 lb

There will be five generating units in the power plant, which will be of the outdoor type. The building below the generator floor, at El. 556, will be of reinforced concrete and will house the generating units. Each unit will consist of a 45,000 kva, 13.8-kv, 60-cycle, vertical-shaft generator with a direct-connected exciter driven by a 62,200-hp turbine. Seven cranes, including a 225-ton gantry, will be installed to handle various items of power-plant equipment.

Hydraulic turbines will be vertical-shaft, single-runner, Francis-type units designed for operation at 94.7 rpm. The elevation of the water surface in the reservoir for the production of power will fluctuate from a maximum of 647 with flood storage capacity completely full, to the minimum at about 570. Initially, the surface of the water in the tailrace with a low-water flow of 5,000 cfs will be about El. 520.

Power Plant and Switchyard Locations

In future it is expected that the river bed below the dam will retrogress to produce somewhat lower elevations of the water surface in the tailrace than exist at the present time. In order to provide for this possibility, the power plant is designed for a minimum tailwater surface at El. 500. The center line of the inlets to the turbine runners will be at El. 513. The average elevation of the water in the tailrace will be at El. 510, which corresponds to a flow of 15,000 cfs. The normal net effective head under which the turbines will operate initially may vary from a minimum of about 110 ft to a maximum of 130 ft. A minimum head condition will occur only at infrequent intervals, and the average net effective head will be approximately 120 ft. Turbine designs call for production of 62,200 hp at full gate opening when operating under a 120-ft net head.

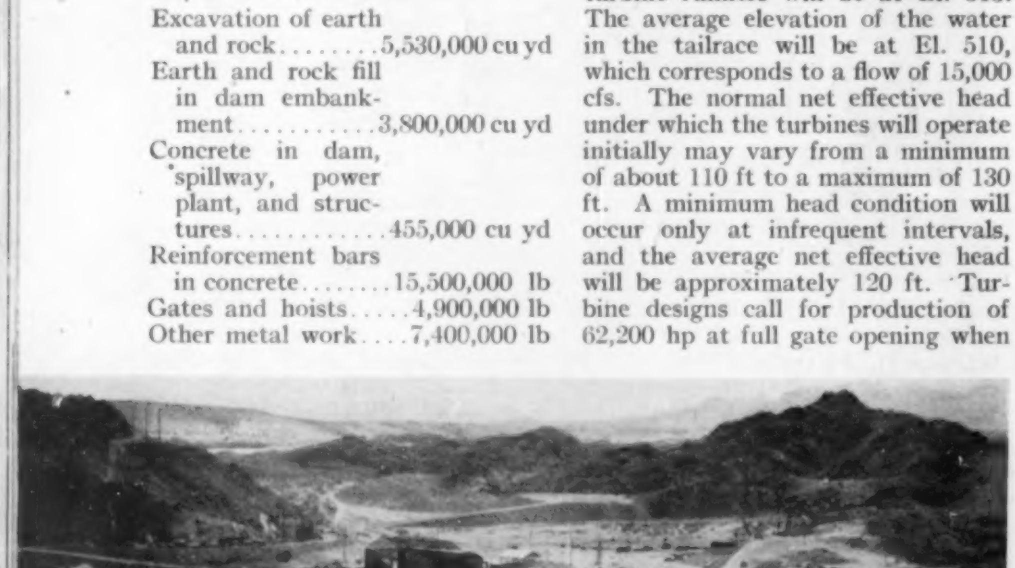
The switchyard will be located in the area between the intake structure, the dam, and the forebay. Transformers, switches, and protective equipment will be installed for transforming generator voltage to the required 69-kv and 230-kv transmission values. Generator voltage will be stepped up in the 230-kv switchyard through five 49,500 kva banks, each bank to consist of three 16,500 kva single-phase transformers rated at 13.2/138–230-kv.

Interconnecting Transmission Lines

Efficient operation of the Davis power plant will necessitate complete interconnection with the Parker power plant and transmission system, and extensions to the present system for supplying power to the pumping plants of the Gila Project and to commercial markets in the Southwest. Present plans call for system extensions that will make electrical power available in sufficient quantities and at such rates that the areas to be served will receive ultimate benefits from the Bureau of Reclamation multiple-purpose projects on the Colorado River.

Included in the 230-kv construction program are the switchyard and terminal facilities at Davis Dam and the interconnection between the Parker power plant and the Metropolitan Water District system. One or two 230-kv transmission lines will be constructed for interconnection between the Davis and Parker power plants. Terminal facilities at Parker Dam to accommodate the interconnection will consist of two 90,000 kva banks and associated switching facilities.

Additions to the 161-kv Parker transmission system include a second Parker-Phoenix transmission line which was rushed to completion in January 1946 to make up the power shortage in central and southern Arizona. A second 45,000 kva, 154/-115-kv transformer bank will be installed in the Phoenix switchyard to serve the second Phoenix-Tucson transmission line. Present load growths in the central and southern part of Arizona indicate that it may be necessary to provide an additional transformer bank and third synchronous condenser in the Phoenix substation during the final stages of



MATERIAL EXCAVATED FROM 4,500-ft-long diversion channel, on Arizona side of river (foreground), is carried across wood trestle to spoil area on Nevada side. Contract allows 1,200 days for completion of diversion channel project.

completion of the project. Power requirements in connection with the development of the Gila Project and increased power requirements in the Yuma Valley in Arizona and Imperial and Coachella valleys in Southern California will make it necessary to construct a second 161,000-v transmission line from the Parker power plant to serve these areas.

Transmission System Expanded

A second 115,000-v transmission line is currently being constructed from Phoenix to Tucson for the delivery of power from Davis Dam. The present Bureau of Reclamation 115-kv line, together with generating facilities in the area, has proved inadequate to serve the rapidly increasing power requirements in this area. One 20,000 kva synchronous condenser, additional transformers, and associated switching equipment will be installed in the Tucson substation in connection with the construction of the second Phoenix-Tucson transmission line.

The Sulphur Springs Valley Rural Electrification Administration and the Arizona Edison Co. at Douglas and Bisbee have made applications for electric power service which will involve an extension of the Parker-Tucson 115-kv transmission system. To serve this area, it is presently planned to construct a 115-kv transmission system eastward from Tucson for ultimate interconnection with the Elephant Butte 115-kv power system of the Rio Grande project at Deming, N.Mex. Mutual interchange of power will then be possible between the two systems. The 115-kv transmission system from the Parker Dam power plant and the Davis Dam projects will also be extended northward from Phoenix to the Prescott, Ariz., area to provide power to load centers at Wickenburg and Prescott, with possible future supply to areas in northern Arizona.

Power for Construction Purposes

Part of the 69-kv construction power circuits to provide Boulder Dam power for construction purposes at the Davis Dam site may also be integrated in the permanent transmission system. Initial delivery of construction power to the dam site has been made over a tap line extending from Davis Dam to the Boulder-Needles transmission line of the California-Pacific Utilities Co. This circuit will provide transmission capacity for 3,000 kw at 69 kv.

To augment this supply and to provide an emergency power source, a similar 69-kv line is being constructed from the dam site 30 miles eastward to the Boulder-Kingman transmission line of the Citizens Utilities Co. A combined total of 5,000 kva of Boulder power will thus be made available to the contractor and to the government camp through a temporary construction power substation adjacent to the dam site.

MODEL OF DAVIS DAM shows spillway, power house, and other details of project. Design of upstream face calls for layer of dumped rock riprap of increasing thickness from top to bottom with outer slope of 1 on 3. Downstream face, also rock fill, has slope of 1 on 2½ from crest El. 655 to El. 575, and 1 on 12 beyond that point, terminating at grade of power-house access road, El. 556, then 1 on 3 below this elevation to intersection with river bed.

Other miscellaneous extensions to the interconnected system are planned, consisting of several short low-voltage transmission lines and additions to switching facilities and substations that will be required to form a modern integrated power system for the Parker and Davis power systems. Initial construction will consist of a second circuit from the Gila substation to the Yuma area.

Large Power Demand Foreseen

The State of Nevada has also made application for a block of power from Davis Dam. Studies are being made to determine the best method of complying with the state's request. Detailed locations have not been decided on for the transmission-system routes, and certain changes in the project previously described will undoubtedly become necessary before construction is completed.

The annual firm output of the Parker Plant and the output from the Davis installation will be approximately 1,400,000,000 kwhr. The estimated annual output of the two plants is based on the assumption that the full capacity of the Parker power plant will be available to the United States. The Metropolitan Water District of Southern California has the right to one-half the capacity of the Parker power plant after 1952. When the District exercises this right, the amount of power available to the government will be inadequate to supply the requirements of the area to be served by the combined power system. Thus, even with the addition of Davis Dam, it is clear that the prospective demand in the market area of Parker and Davis power plants will absorb their full output practically from the start.

Construction costs of the Davis Dam project are estimated at $77,000,000 on the basis of 1945 prices. This includes the dam, power plant, and the entire transmission system. Of the total, it is estimated that $47,000,000 will be spent for construction of the dam, spillway, power plant, and other appurtenant works at the dam site. The remainder, $30,000,000, is required for the transmission lines and substation to be built in the future to meet demands for additional power.

1949 Completion Date

Every effort is being made to have the Davis power plant on the line—with ultimate capacity installed and major transmission extensions completed—by the latter part of 1949.

Work on the Davis Dam project is under the direction of the Bureau of Reclamation, headed by Commissioner Michael W. Straus, in Washington, D.C.; Walker R. Young, M. ASCE, is chief engineer, with headquarters at Denver; and E. A. Moritz, M. ASCE, is Regional Director of Region III, in which the project is located, with headquarters at Boulder City. H. F. Bahmeier, Assoc. M. ASCE, is in immediate charge of the work as construction engineer for the Bureau of Reclamation, and H. E. Williams, M. ASCE, is project manager for the contractor, the Utah Construction Co.

Precast Floor Slabs Speed U.N. Housing Project

MASS PRODUCTION METHODS of precasting floor slabs are expediting the work on a 110-building United Nations housing project—to be known as Parkway Village—which is under construction on a 40-acre plot near the site of the 1939–1940 World's Fair in the Borough of Queens, N.Y.

When completed, this project will provide housing for U.N. personnel primarily, the U.N. having underwritten the first three years' rental. Disposition of the buildings after the three-year period will depend upon whether the U.N. headquarters remains in New York.

Owner of Parkway Village is the Savings Banks Trust Co., which represents a number of participating Mutual Savings Banks. Leonard Schultze Associates, New York, are the architects; Madigan-Hyland, New York, engineers; and George A. Fuller Co., builders.

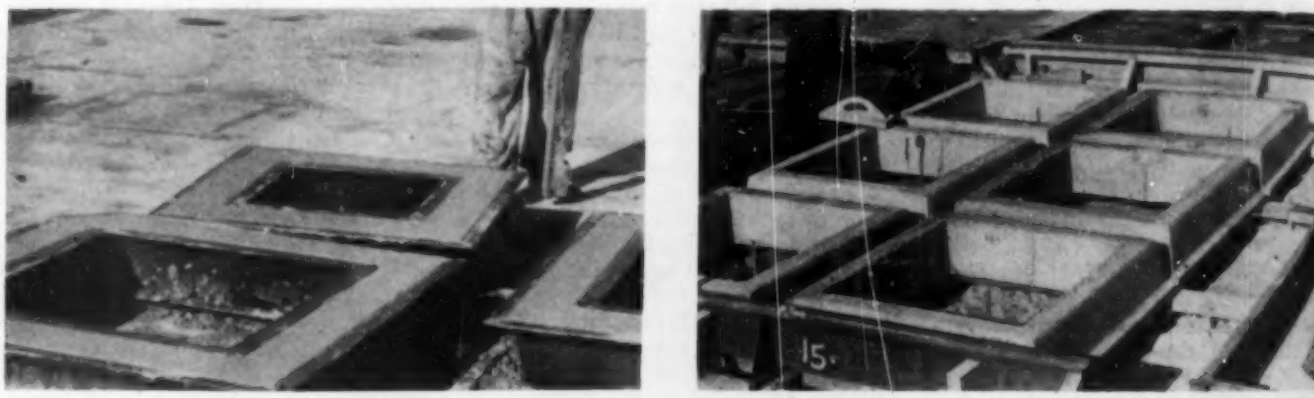
New Design Features

Foundation construction is concrete, exterior walls are cinder blocks with brick facing, floors are precast concrete slabs, and roofs are slate on wood framing, or Porete slabs on light steel trusses.

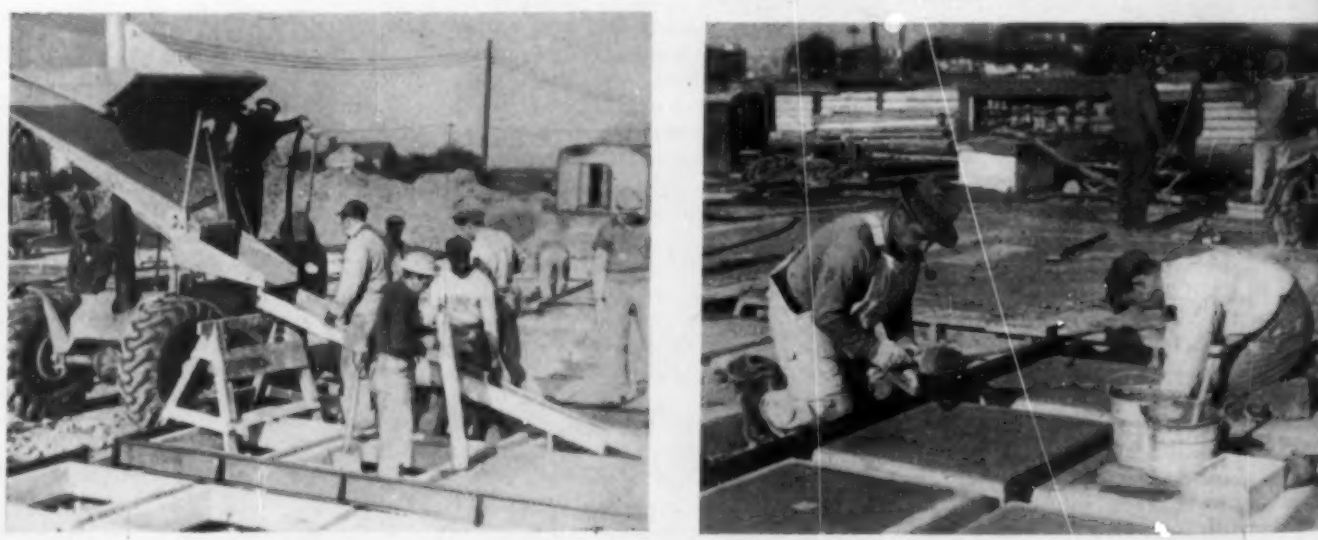
Nine different designs comprise the 110 buildings. They are Colonial design—duplex or three story, depending on the difference in outside terrain. Buildings will be heated from a central high-vacuum steam heating plant, oil burning. The 40-acre layout will be landscaped, will have paved roads, central garage facilities, and a shopping center. Less than 20 percent of the site is used for buildings, providing open vistas usually of at least 100 ft.

Presented here is a step-by-step description of construction of the forms for precasting as many as 60 concrete slabs per day. The design was developed by E. H. Praeger, M. ASCE, member of the firm of Madigan-Hyland. The vacuum process of curing and lifting was developed by K. P. Billner, of the Vacuum Concrete Co. The pictures in this series show the casting and placing of the floor slabs.

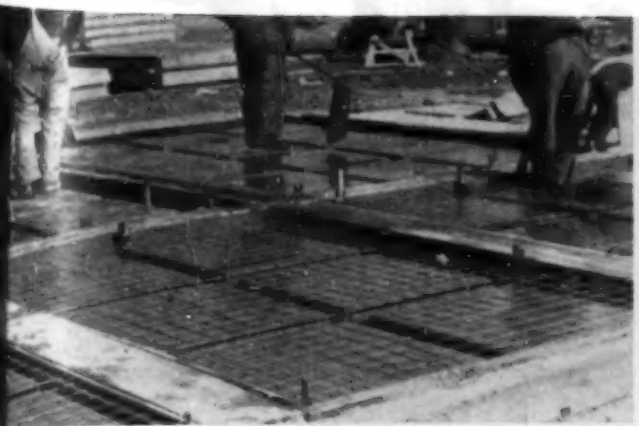
Variations in the types of floor slabs needed were held to a minimum to simplify the form work. A total of 6,800 slabs will be cast, and approximately 100 molds will be used



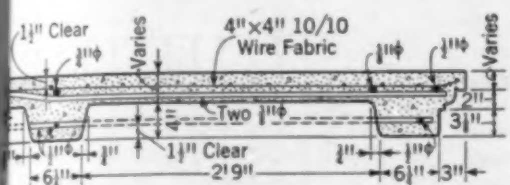
1 CONCRETE SQUARES averaging 2 ft 9 in., outside dimension, are individually cast (left) and placed within steel forms (right) as first step in constructing matrix for reinforced-concrete floor slabs. Compressed-air pipes built into forms have vertical riser at center of each square.



2 REPLACING HAND-PUSHED CARTS, Buggymobile of 1-yd capacity (left) pours heavy form base with concrete from central mix plant. Surfaces of form are carefully troweled (right). Small metal plates covering ends of compressed-air risers are seen at centers of squares.

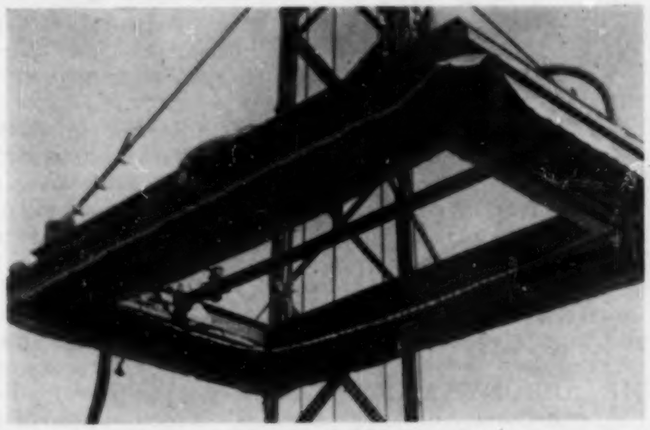


3 REINFORCEMENT FOR FLOOR SLABS—shop welded on job—is placed over treated surface of mold. Surface treatments consist of coat of clear lacquer on mold before first use, and a mopping (background) of castor oil before each slab is poured.

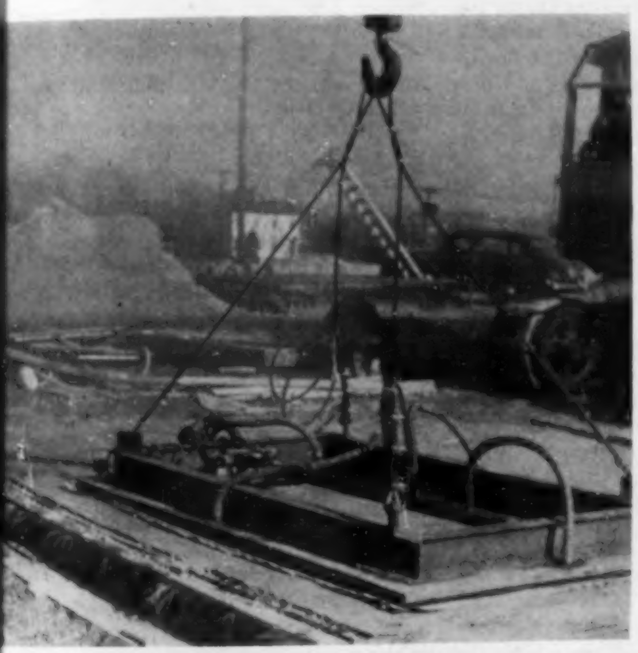


SECTION THROUGH EDGE of slab shows structural details of precast floor.

4 CONCRETE FLOOR SLAB is poured, screeded and troweled. Excess water is removed by vacuum process.

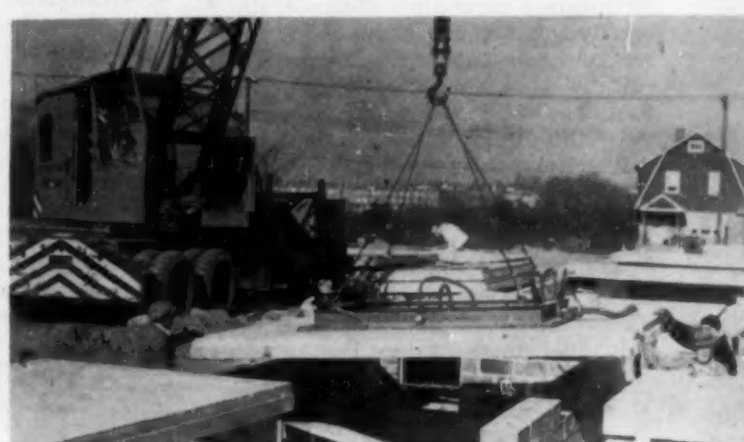


5 VACUUM LIFTING FRAME, about 9×12 ft (above), is swung into position by crane for lowering onto slab. Lifting capacity of frame is about 50,000 lb, vacuum being 10 psi. Slabs weigh from 6,000 to 8,000 lb.



6 SHOT OF COMPRESSED AIR through built-in risers separates concrete slab from form (left, top) to facilitate lifting heavy slab by means of vacuum lifting frame (left, bottom).

7 PRECAST SLAB IS LOWERED onto concrete foundation and interior cinder-block wall. Average building floor requires 24 precast slabs. Slabs for second floor serve as ceiling for first, obviating plastering and other special treatment.



Simple Model Tests Predict Aerodynamic Characteristics of Bridges

Part I. Response Curves Computed from Pressure Distribution Graphs

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PART II of this paper—which will appear in the February issue of CIVIL ENGINEERING—*describes an alternative method of deriving and plotting aerodynamic response graphs, using the static lift and torque graphs of the section, such as are obtained by holding a small section model stationary in a wind tunnel.*

THE AERODYNAMIC STABILITY or instability of bridge sections is entirely predictable, both in direction and intensity, for all wind velocities and for any angle of attack, without elaborate, costly and time-consuming tests on large-scale models of complete structures. All that is needed is a simple test, requiring only a few minutes of time, on an elementary, small-scale model of the cross section.

For the most accurate determination of the aerodynamic characteristics, a simple pressure-distribution measurement is made. The section model may be only a few inches in dimension, and the test can be made in a miniature wind-tunnel. The model is held fixed at a small angle of incidence and the pressure is measured by manometer readings at about six points across the width of the section. From the pressure-distribution curve thus obtained, the aerodynamic response curves for the section can be accurately and scientifically computed by the writer's formulas.

In the absence of such pressure-distribution curves for a given section, almost identical results may be obtained from the lift and torque graphs of the elementary section model held stationary at varying angles of incidence in a wind tunnel. The complete actual testing of an individual model takes but a few minutes, since the system is completely automatic.

Typical pressure-distribution curves, for two different H-sections, are shown in Figs. 1 and 2. These were obtained for the writer, through the cooperation of Prof. Hunter Rouse, M. ASCE, using a miniature wind tunnel at the Iowa Hydraulics Institute, University of Iowa.

The pressure-distribution graph for a section ratio of $d/b = 0.16$, where d is the girder depth and b is the width of the section, appears in Fig. 1. The upper diagram shows the measured pressures along the top and bottom faces of the section, for an angle of incidence of 5 deg. For an upward angle of incidence, the upper face shows a negative pressure throughout, because of shielding. The lower face shows a tapering negative pressure over the length shielded by the leading girder, changing to positive pressure in the far unshielded corner. The algebraic difference between the top and bottom pressure ordinates yields the net pressure forces, shown in the lower diagram. The area of the lower diagram (the integration of the curve) gives the vertical lift resultant, and the center of gravity of the area gives the point of application of the lift resultant. In this case the lift resultant is obviously positive (upward), and its line of action is obviously to the right of the center line, producing a negative (counter-clockwise or "diving") torque. Since downward motion of the section produces a relatively upward angle of incidence, and since an upward angle of incidence in this case produces an upward aerodynamic resultant (opposing the motion), this section is

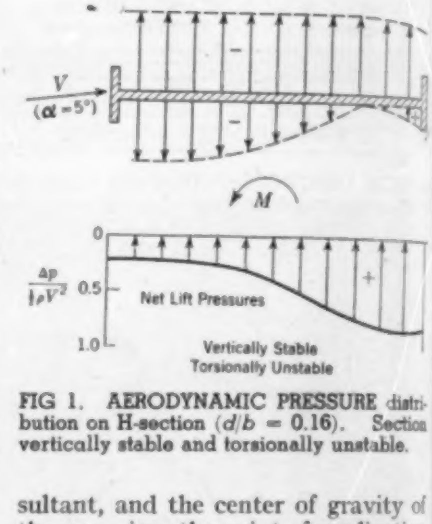


FIG 1. AERODYNAMIC PRESSURE distribution on H-section ($d/b = 0.16$). **Section vertically stable and torsionally unstable.**

This article is an appeal, to those who have the test facilities, for scientific cooperation. The writer needs more basic tests on various standard bridge cross-sections, and on suggested modifications of those cross-sections, to complete the derived data and conclusions in a form readily usable by the profession. This information will enable engineers to predict, prescribe, and design, in full confidence and knowledge. They can thereby provide assured safety of existing and future structures without extravagant design or clumsy proportions and without requiring repeated recourse to time-consuming and prohibitively costly model tests for every new bridge and for each successive preliminary design for a project. The full goal is to establish sections or modifications of sections that will yield assured aerodynamic stability, both vertical and torsional, at all wind velocities and at all angles of incidence. From a few suggested tests that have been made available, the writer has been able to compute and plot much valuable information.

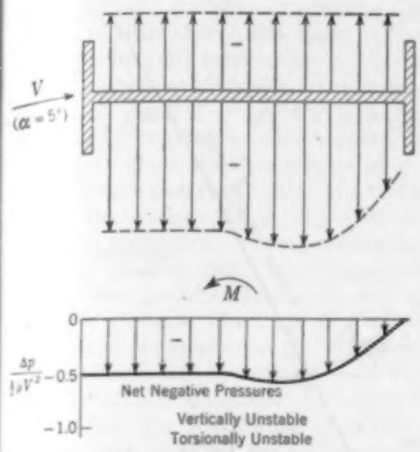


FIG. 2. **AERODYNAMIC PRESSURE distribution on H-section ($d/b = 0.33$). Section vertically and torsionally unstable.**

vertically stable. Moreover, since downward (counterclockwise) rotation of the section also produces a relatively upward angle of incidence, and since an upward angle of incidence produces a downward (counterclockwise) torque (reinforcing the motion), this section is *torsionally unstable.*

Shown in Fig. 2 is the pressure distribution graph for a deeper H-section, with a section-ratio of $d/b = 0.33$. The deeper girder in this case produces a more effective shielding of the bottom face of the deck, producing negative pressures exceeding the normal negative pressures on the top face. The net pressures, by subtraction, are plotted in the lower diagram. In this case the resultant lift is *downward* (negative) and, since this resultant is located to the left of the center line, the resultant torque is also negative (counterclockwise). Consequently this section is both *vertically and torsionally unstable.*

Similar pressure-distribution graphs for other section ratios appear in Fig. 3. These are drawn by interpolation, using the two curves furnished by Professor Rouse and the curve plotted from Eiffel's data for a flat plate ($d/b = 0$). A particularly interesting section-ratio is approximately 0.24, because it is a *neutral* section for vertical stability. The curve crosses the axis, yielding balanced negative and positive areas and consequently a zero lift resultant. Similarly a section ratio of approximately 0.08 is a neutral section for torsional stability, because it yields a centered resultant or zero torque.

A section is here termed vertically or torsionally *stable, neutral,* or *unstable* to designate its aerodynamic response at high wind velocities, in the critical high-velocity or "catastrophic" range. The same sections will usually have minor alternating ranges of stability and instability at lower wind velocities, as shown in the calculated aerodynamic response graphs illustrated by Figs. 4–7 (also 12, 14, Part II). These graphs, which give the complete aerodynamic picture for the respective sections, are computed directly from the pressure-distribution curves of Figs. 1, 2, and 3, by a simple integration.

Aerodynamic instability is measured by the rate of amplification per oscillation cycle,

$$\delta = \frac{\Delta a}{a} = \frac{\Delta W}{2W} \quad . \; . \; . (1)$$

where a is the amplitude, Δa the increase in amplitude, W the energy of the oscillating structure, and ΔW the energy input per cycle. The logarithmic increment δ, applied to any initial amplitude, is like a rate of compound interest, compounded at each oscillation. By the writer's analysis (see "Rigidity and Aerodynamic Stability of Suspension Bridges," by D. B. Steinman, ASCE TRANSACTIONS, Vol. 110, 1946, pp. 439–580), a very simple formula may be written for δ:

For *vertical* instability,

$$\delta = 0.01 B . A \frac{V}{Nb} \quad . \; . \; . (2)$$

where B is the (constant) width-factor of the section ($B = b^2/w$) having a mean normal value of 0.50; V/Nb is the relative wind velocity, that is, the velocity measured with the width b as the unit of length and the period of oscillation ($1/N$) as the unit of time; and A is the (variable) aerodynamic factor, also given by a very simple formula:

$$A = -\int_0^1 p \cos \varphi \, dx \quad . \; . \; . (3)$$

where the integration extends over the width of the section. Here p is the variable ordinate of the pressure-distribution curve (Figs. 1–3) per unit angle of incidence; and the multiplier $\cos \varphi$ is the correction for phase difference (analogous to the power factor applied to the product of volts by amperes in alternating current).

An aerodynamic flow disturbance, initiated at the leading edge, takes time to traverse the width and encounters a progressively increasing difference of phase as it traverses the oscillating section. The phase difference φ increases in a straight-line ratio from zero at the leading edge to a maximum of $\varphi_1 = Nb/V$ at the far edge of the section, so that $\varphi = x . \varphi_1$. This correction factor for *phase difference*, introduced by the writer, is significant. It explains the otherwise mystifying variation of aerodynamic response at different wind velocities.

For torsional instability, only one factor ($b^2/2r^2$, with a mean normal value of 4.0) is added to Eq. 2:

$$\delta = 0.01 \frac{b^2}{2r^2} B . A \frac{V}{Nb} \quad . \; . \; . (4)$$

where r is the polar radius of gyration of the mass of the cross section; and the formula for A becomes

$$A = -\int_0^1 p \left(\frac{1}{2} - x\right) \cos \varphi \, dx \quad . \; (5)$$

with the new factor representing the lever arm of each ordinate about the center.

(In accordance with the convention in fluid mechanics, the ordinates plotted in Figs. 1 to 3 are pressure differences divided by $\frac{1}{2}\rho V^2$. Those ordinates, per degree increment of angle of incidence, multiplied by 57.3 for angular measure, are used as the values of p in Eqs. 3 and 5.)

Vertical Instability Graphs

In Fig. 4 appear the vertical instability graphs for three different H-sections: a *stable* section ($d/b = 0.16$), a *neutral* section ($d/b = 0.24$), and an *unstable* section ($d/b = 0.33$). These graphs are computed directly from the respective pressure-distribution curves of Figs. 1, 2, 3, using the

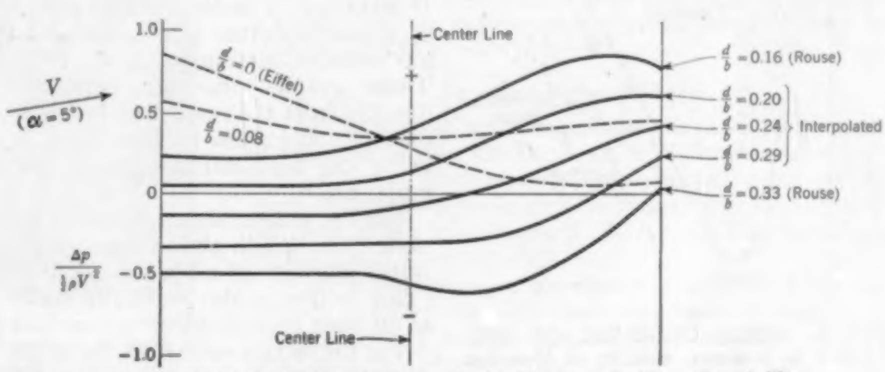


FIG. 3. **NET PRESSURE DISTRIBUTION graphs for H-sections ($d/b = 0$ to 0.33).**

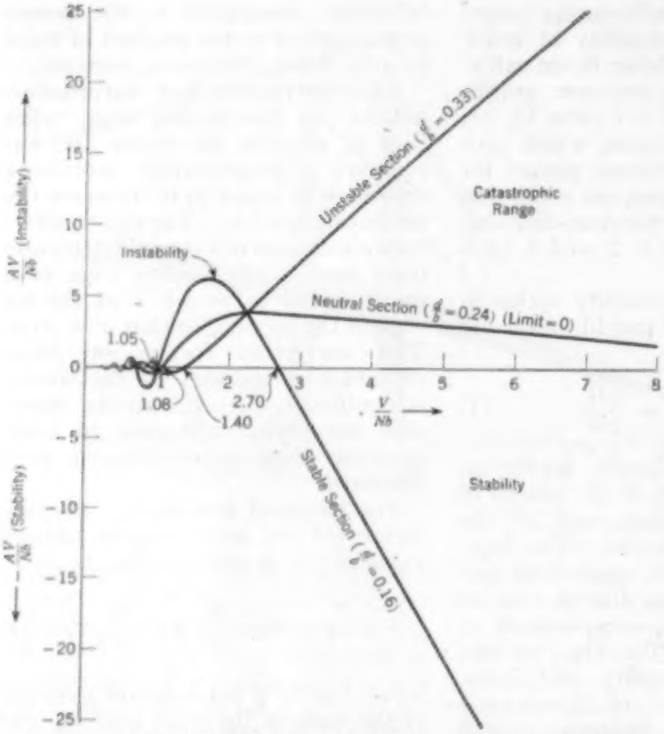


FIG. 4. VERTICAL INSTABILITY GRAPHS for three H-sections: stable section, d/b = 0.16; neutral section, d/b = 0.24; unstable section, d/b = 0.33.

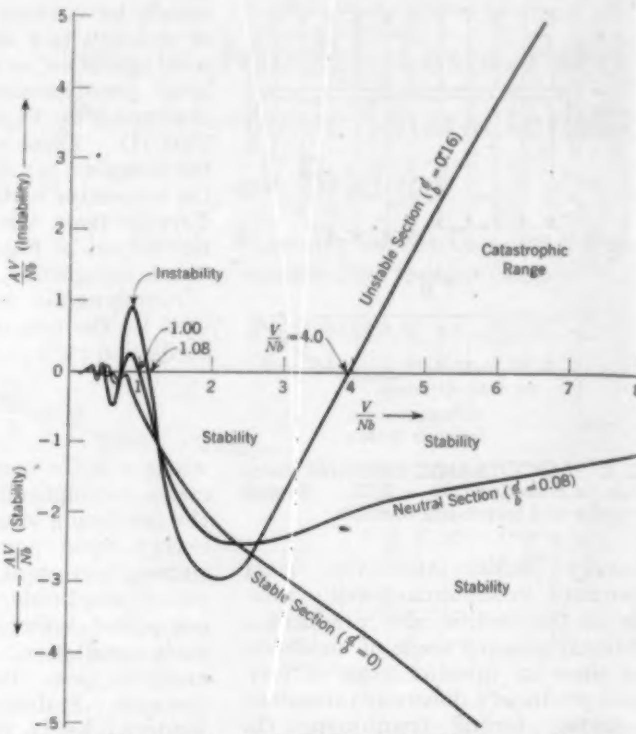


FIG. 5. TORSIONAL INSTABILITY GRAPHS for three H-sections: stable section, d/b = 0; neutral section, d/b = 0.08; unstable section, d/b = 0.16.

simple integration formula, Eq. 3. The abscissas are the relative velocities V/Nb, and the ordinates are the coefficients of aerodynamic instability, AV/Nb, the variable term of Eq. 2.

For the section ratio 0.16, the graph shows assured vertical *stability* in the high-velocity range, above a critical V/Nb of 2.7. Above this value, any increase in wind velocity V makes the bridge more stable, quickly damping any initiated oscillations. Below this velocity ratio there is a range of limited instability, preceded by minor alternating ranges at lower velocities.

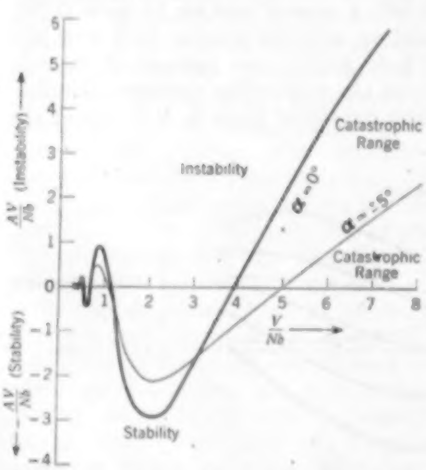


FIG. 6. EFFECT OF ANGLE OF INCIDENCE on torsional stability of H-section (d/b = 0.16, α = 0 and ±5 deg).

These instability ranges explain the vertical oscillations of the Tacoma Bridge at low wind velocities.

For the section ratio 0.33, the graph shows a catastrophic range of vertical *instability* starting at a critical V/Nb of only 1.40, with minor alternating ranges at lower velocities.

For the section ratio 0.24, the graph shows an optimum, intermediate response. The instability range converges toward the horizontal axis, approaching zero as a limit at high velocities; and the maximum ordinate is lower than for other sections, so that a smaller total positive damping will assure stability at all wind velocities.

Torsional Instability Graphs

In Fig. 5 are shown the torsional instability graphs for three different H-sections: a *stable* section (d/b = 0), a *neutral* section (d/b = 0.08), and an *unstable* section (d/b = 0.16). These graphs also are computed directly from the respective pressure-distribution curves of Figs. 1, 2, 3, using the torsional integration formula, Eq. 5.

For the section ratio d/b = 0 (a flat plate), the graph shows assured *torsional stability at all wind velocities*. (This section is also vertically stable at all wind velocities.)

For the section ratio 0.16, the graph shows a steep *catastrophic range* (like that which destroyed the Tacoma bridge), starting at a critical V/Nb of 4.0, with alternating ranges of stability and instability at lower velocities.

For the neutral section ratio 0.08, the graph shows assured *stability* at all velocities above a low critical V/Nb of 1.0, with minor humps at lower velocities, representing negligible instability that is easily overtopped by normal structural damping. In this case, the asymptotic range for the neutral section is below the axis,

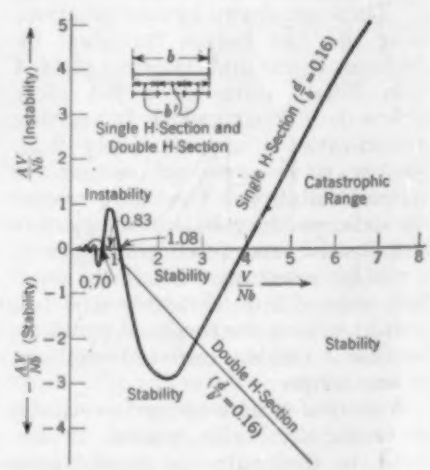


FIG. 7. TORSIONAL STABILITY of double H-section compared with instability graph of single H-section (d/b = 0.16).

representing stability, whereas in Fig. 4 it was above the axis, representing (limited) instability.

The pressure-distribution curves shown in Figs. 1–3 are for a 5-deg angle of incidence. Corresponding curves for several other angles of incidence were also recorded in the tests. From the values of p at different angles of incidence, corresponding instability curves may be computed.

The two graphs shown in Fig. 6 (for $d/b = 0.16$) illustrate the effect of angle of incidence on the torsional instability of an H-section. As the angle of attack is increased from zero to ±5 deg, the instability is materially reduced, and the critical velocity is raised. With further increase in the angle, this section would become aerodynamically neutral at ±15 deg and stable at steeper angles of incidence. A stable H-section would show the reverse variation for increasing angle of incidence.

Similar graphs for vertical aerodynamic response show similar but smaller variation of stability or instability with increase in angle of incidence.

Applied to Special Sections

An interesting proposed section is made up of two H-sections in tandem, with an open gap between them. Without additional tests, the aerodynamic characteristics of this section can be computed. Using the pressure-distribution curve for $d/b = 0.16$ for the windward half, and the same curve reversed in sign and proportionately reduced in scale for the leeward half, Eq. 5, yields the torsional response graph which is plotted in Fig. 7.

This graph shows strong torsional *stability* at all wind velocities above a low value of $V/Nb = 0.8$, and only a small hump of negligible instability in the lower range. As anticipated, this graph is almost identical in form with the *vertical* stability graph (Fig. 4) for a single H-section of the same d/b, but greatly reduced in scale. A section that is vertically stable when used singly, will be torsionally stable when used in tandem, and a section that is vertically unstable when used singly, will be torsionally unstable when used in tandem.

Planes Launched from Small Fields by Electropult

A LINEAR ELECTRIC MOTOR more than a quarter of a mile long is the latest answer to the problem of launching jet-propelled and robot planes and heavy bombers from ships or small landing fields without the initial impact of conventional catapults. This new device, called the "electropult," was designed and built by engineers of the Westinghouse Electric Corp. for the U.S. Navy.

The electropult is essentially a huge electric motor laid out flat. The track corresponds to the rotor of a conventional machine, and the small shuttle car running along it acts as the stator. In operation, a plane is hitched to the shuttle car, which speeds down the track and tows the plane into the air. In recent demonstrations at the Naval Air Test Center, Patuxent River, Md., the electropult launched a jet-propelled plane at 116 miles an hour in 4.1 sec after a run of only 340 ft. Unassisted the plane would have required a run of about 2,000 ft for the takeoff. Running free, without load, the shuttle car has built up a speed of 226 miles an hour in slightly less than 500 ft.

PLANE IN BACKGROUND is at starting Point of electropult at Naval Air Test Center, Patuxent River, Md. Central portion of track is core of Westinghouse 1,382-ft-long linear induction motor.

Two Such Installations

Two electropults have been built for the Navy, the first installed at Mustin Field, Philadelphia, and the other at the Patuxent River Base. The latter, here pictured, is the more advanced model although both are fundamentally the same. At Patuxent River the electropult is installed on a 2,800-ft concrete runway, 100 ft wide. The truck, 1,382 ft long, is mounted flush with this runway above a concrete trench which contains the copper bus bars that carry current to the motor. Sunk into the concrete on both sides of the track are rails to carry the shuttle car.

The shuttle car itself is $11^1/_2$ ft long, $3^1/_2$ ft wide, and extends only 5 in. above the track. To harness the plane to the car, a bridle of steel cable is used. The plane rides along the track on its own wheels and when flying speed is reached the car is stopped, the bridle drops off, and the plane takes to the air.

To Launch Largest Airliners

The electropult has no apparent limitations in speed or capacity within the range of requirements now foreseen. Designs have already been completed for one capable of launching the largest existing airliners at 120 miles per hour with a takeoff run of 500 ft. Such airliners now need a run of about 4,000 ft.

Other possibilities for the electropults besides aircraft carriers are floating airports or seadromes, barge-type airports on city waterfronts, mid-city airports, and revival of outgrowth airports.

Safeguarding Hydro Plants Against the Ice Menace

PAUL E. GISIGER, M. ASCE

Pennsylvania Water and Power Company, Baltimore, Md.

FOR YEARS the protection of hydroelectric plants from ice was a fight in which muscular strength and human endurance were pitted against ice, water, and cold. Better design and location of structures and installation of protective devices have made the fight against ice less strenuous and hazardous and have practically eliminated costly outages of power-producing turbines during winter freezes. A number of successful methods of operation are described by Mr. Gisiger in this article, which was presented before the Power Division of ASCE.

AT MANY HYDROELECTRIC installations on the North American Continent ice and freezing conditions are important considerations in plant design and in operation. Great pressures from sheet ice, clogging of intakes, and freeze-up of gates, valves, and screens are a few of the threats of winter to plant operators. To combat ice, a number of expedients have been tried, some of them most successfully. None, however, has eliminated the need for proper attention to the problem by the plant designer.

For some time exaggerated views were current about the magnitude of the horizontal pressure of an ice sheet against a dam. Figures up to 60,000 lb per lin ft were mentioned, based on the fact that in a testing machine a block of ice may develop a compressive strength of about 400 lb per sq in. It is obvious that an ice sheet, about 200 ft square and 12 in. thick, is a poor medium for transmitting pressure parallel to the plane of the sheet. It will buckle at a small fraction of the ultimate compressive strength of the ice itself.

Another fact that works against the forming of great ice pressure against hydraulic structures is that ice is one of the most susceptible of all solids to plastic deformation and the effects of a pressure build-up are quickly reduced or nullified by a volume change.

From these considerations, which are supported by test data and field measurements, it is possible to state that static ice pressure, except in very confined areas or spaces, will, under the most severe climatic conditions, seldom exceed 10,000 lb per lin ft.

Horizontal pressure however is not the only way in which ice can transmit external forces to a dam or bulkhead. A sheet of ice of considerable thickness frozen solidly against the upstream face of a dam can, with a rise in the water level, produce a considerable upward force along the face of the dam before it breaks away. Recent Swedish observations indicate that this force may approach 1,000 lb per lin ft.

The relative influence of both the horizontal and vertical forces exerted by ice decreases as the height of the dam increases, as the magnitude of these forces is the same for any height. They may therefore control the design of a low dam but will affect only the top portion of a high dam.

So far, our concern has been only with static forces. Dynamic forces, however, may give more concern than the static forces.

Many rivers are subjected to a heavy movement of ice. This movement proceeds with fits and starts, temporary stoppages, forming ice jams until increasing river flow and decreasing amount and solidity of ice allow the river to make a clear sweep.

AIR BUBBLER SYSTEM is simple means of preventing formation of ice against gates.

The Susquehanna River has been notorious for ice movements and ice jams. At the end of the severe winter of 1936 an ice push of unusual magnitude occurred, during which the ice against the Safe Harbor Dam was subjected to impact pressures sufficient to raise it into piles 25 to 30 ft high within a few seconds. On two of thirty-two gates, some permanent deformations of skin plates and secondary supporting beams occurred. The force against the gate was equivalent to a static load of 10,000 to 15,000 lb per lin ft applied in a horizontal band 18 in. wide, but not acting over the full width of the gate.

Heavy Gates Not Justified

It is not justifiable to build gates to withstand these extremely rare pressures. Damage such as has been mentioned does not affect the stability of the dam and is repaired easily, whereas a gate structure heavy enough to withstand such a pressure would add to the investment in gates, lifting equipment, and operating bridge, out of proportion to the risk.

The intake structures on a hydroplant, however, must be protected against masses of ice piling up in front of them, as well as against ice cakes being drawn against the racks, where the current will hold them against the bars. In older and smaller plants this is the most com-

SKIMMER WALL AND BOOM are effective in keeping floating ice from intake of Safe Harbor Dam.

mon source of trouble, or even complete shutdown, in winter.

Safeguarding against this eventuality begins when the general features of a new plant are decided upon. The larger the pond area above the dam and the deeper the intake below the water surface, the fewer the ice troubles. Any dam or power development located immediately downstream from any other dam is well protected against a large amount of ice jam. Even a large backwater lake and another dam right above it may not prevent trouble from floating broken-up ice if the layout of the plant is such as to allow the drawing of such ice into the intake. Thus the arrangement of dam, forebay, and intake such that ice is kept away from the intake is a prime factor in keeping trouble to a minimum.

Some typical layouts illustrating favorable and unfavorable effects that location and general arrangement may have regarding floating ice are shown in Fig. 1. Arrangements (*a*) and (*b*) on the left of the diagram produce a funnel effect which leads floating ice to the plant intake. Layout (*c*) is typical for a plant in existence for over 30 years on a river frequently transporting an enormous amount of floating ice. Its intake is shallow, but is protected by a barrier between the river and the forebay. This barrier is formed in part by a skimmer wall and in part by heavy log booms floating between anchor piers. The skimmer wall consists of a solid concrete wall supported by open arches. The top of these arches, through which the water has to pass, is 12 ft below the normal pool level. An accompanying photograph shows the effectiveness of this arrangement in keeping ice in a heavily choked river from getting into the plant.

Layout (*d*) is typical for a plant on a large river with a large reservoir protected against ice jams by another dam upstream. Broken-up floating ice from its own pool is prevented from causing trouble by an intake 85 ft below the operating water level.

THRUST OF ICE SHEET brings pressure against Safe Harbor Dam on Susquehanna River.

In many places it is desirable to prevent the formation of ice because it may prevent the operation of some equipment, such as crest gates on dams. In order to make sure that gates can be operated when temperatures are below freezing, such parts as roller tracks and sealing strips must be kept free of ice. This can be done by different methods of heating.

Ice formation in front of a gate can also be prevented by heating. This generally requires housing of the downstream side of the gate. The use of an air-bubbler system appears to be preferable. This consists of a pipe or hose, with a small orifice at its end, placed in front of the gate. The opening is kept at a considerable depth, say 10 ft below the water level, and air under pressure is discharged through the opening. The air is supplied through a main, from which individual supply lines go to each outlet or group of outlets. The discharged air rises to the surface in a stream of bubbles which keeps ice from forming, by agitation of the water surface and by causing a stream of relatively warm water to rise with the bubbles. Such an installation is simpler to install, cheaper to operate, and is less subject to trouble than a heating system.

At Safe Harbor, 32 crest gates 48 ft wide are equipped in this manner, air being supplied from the power-house compressed-air system; the supply header forming one of the railing pipes of the spillway operating bridge. In front of each gate there are two bubbler outlets, at the end of flexible metal hose, which connects with the supply header through a control valve. Just ahead of the valve is a $^{1}/_{16}$-in. orifice, which cuts down the air supply to the outlet to the desired amount without use of the valve. Each outlet takes about 4 cu ft of free air per minute. The outlets are normally 10 ft below the water surface and 5 ft upstream from the face of the gate. During summer they can be withdrawn. With two outlets per

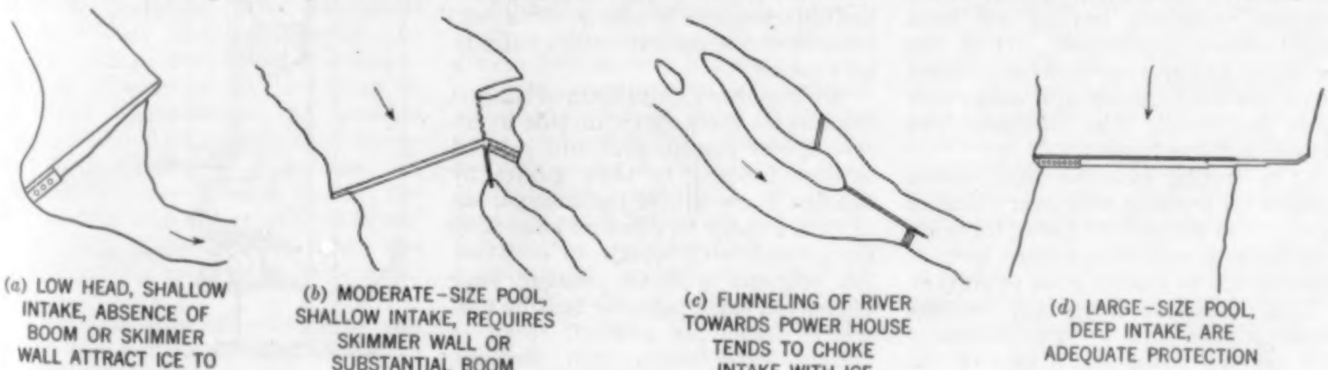
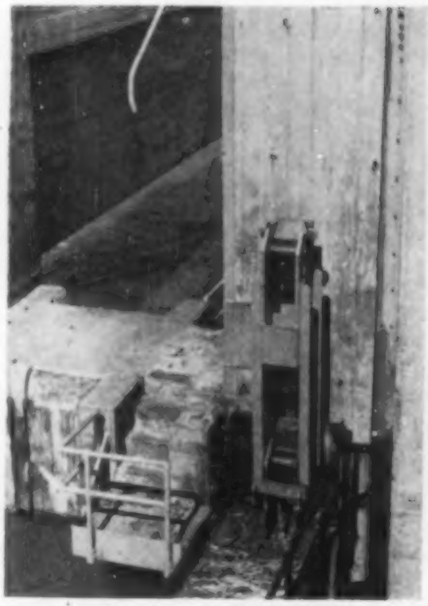
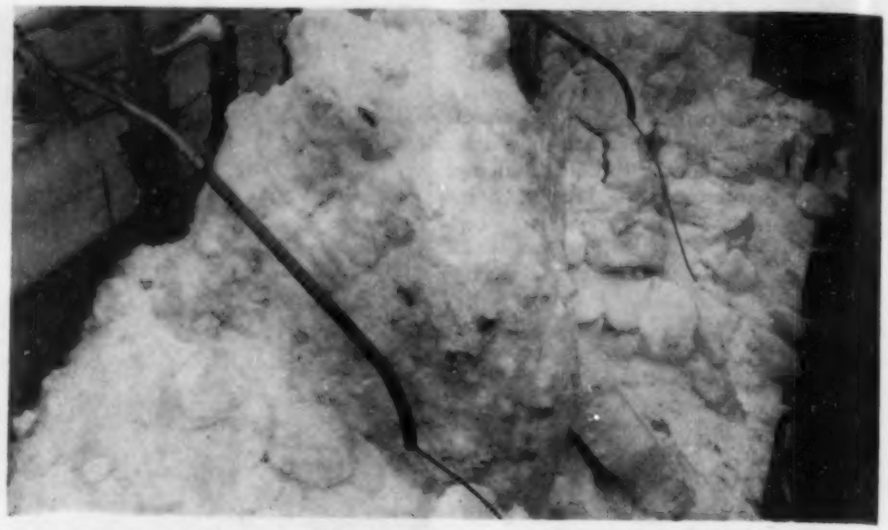


FIG. 1. **TYPICAL HYDRO-PLANT LAYOUTS** where ice problems are encountered include: (*a*) and (*b*) poor layouts; (*c*) and (*d*) improved arrangements.





EXTENSIONS AFFIXED to gate-lifting stems (left) avoid burying by ice (above).

gate, the area immediately in front of the gate can be kept from freezing in the coldest weather experienced, which is about −15 deg F.

Such an installation, while keeping ice from forming against the gates, is of no use during the rare periods when ice is pushed against the gates by a general ice movement. Such movements occur, however, normally when the temperature is rising and the danger of a gate's freezing tight is past.

Dependable operation of crest gates requires, in addition to open water on the upstream side, that gates do not freeze to their guides, supports, roller tracks, or sealing strips, and that lifting equipment can be made to function without fail. On a dam with a considerable number of gates, the heating of only a certain number of gates may be required, but it is advisable to build so that the heating system can be extended to additional gates if desired.

Steam, air, water, oil, and electric current have all been used as heating mediums. In recent developments electric resistance heating has been used almost exclusively. It is the simplest to apply and can be installed with the least trouble and with much less duct work than mediums like steam and hot liquids.

The sealing faces are the critical points for freezing with every kind of gate. On vertical-lift gates, there are the roller tracks, which must be kept free of ice to ensure good operation. Tight seals are important because leakage may build up large masses of ice on the downstream side of the seals, which may cause trouble even if the seals and roller tracks themselves are kept unfrozen.

A typical heating installation for a vertical-lift gate is shown in Fig. 2. The roller track forms the enclosure for one vertical heating element. A second one is placed along the rubbing plate for the vertical seal inside a sheet-metal box, which is a form for the concrete that surrounds it on three sides. These boxes run the full length of the gate guides, and are provided at the top with removable watertight caps through which an electrical circuit can be connected. The heating element is a chrome-nickel wire assembled and held in place on cylindrical sectionalized porcelain units, joined into assemblies of suitable length, cased in metal tubes.

This installation has been satisfactory, although some troubles were experienced from condensation. At first, galvanized tubing was used to enclose the heating elements. Rust from condensation caused flakes of the zinc coating to fall off and ground the resistance wires. This difficulty makes it desirable to use non-corrodible metal for these tubes. It is necessary that any water getting into the heater spaces be able to drain out, because condensation cannot entirely be avoided.

With spillway gates secured against freezing on their upstream side by an air-bubbler installation, and secured against freezing to their guides by heaters, there is still the attachment of frozen spray to gates and handling equipment with which to contend. An efficient tool to combat such effects is a small portable heating unit which discharges a small spray of boiling water under high pressure, so that the water evaporates into steam as soon as it leaves the nozzle.

A hazard somewhat related to that of spillway-gate operating difficulties can be brought about by an ice push such as has been described. The same push which in 1936 caused damage to gates at Safe Harbor also piled masses of ice on top of some gates, making it impossible for awhile to attach lifting equipment. This equipment consists of a gantry-operated lifting beam, which has a hook at each end to engage in pins at each end of the top girder of a gate. With these pins buried under piles of ice, it became necessary for men with shovels to get the ice out of the way before the gates could be operated.

In order to safeguard against such a contingency, the gates were fitted

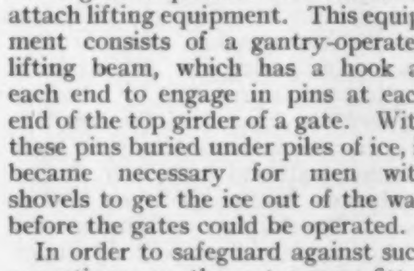


FIG. 2. INSTALLATION OF HEATER BOXES at seal and rollers of vertical-lift gate prevents freezing.

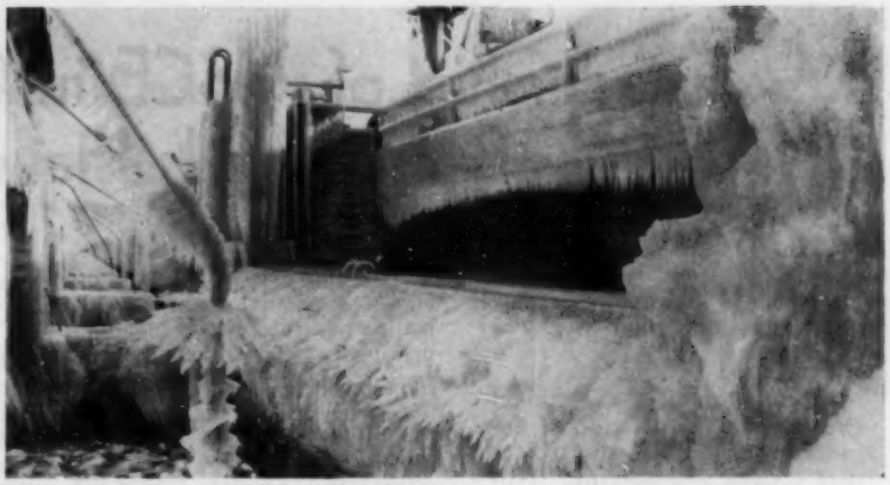
with 6-ft extension stems, providing a second set of lifting pins 6 ft above the original ones, which should be accessible under the worst possible ice conditions. The extension stems are permanently attached to the gates with pivots, but are raised only in wintertime, since their use takes 6 ft from the height to which it is possible to raise the gates and is not desirable under normal operating conditions.

The form of ice that is perhaps most disliked by power plant operators is that commonly known as "frazil ice." This consists of small particles or crystals of ice floating in the water at any depth when and where the water approaches freezing temperature. The temperature range of the water within which frazil ice will occur is quite narrow and extends only from about 0.10+ to 0.05− C. Water at a temperature of less than zero C is paradoxical, but it is possible, and those who wish to know more about the behavior of water while it is close to the freezing point, that is, in an unstable equilibrium between the liquid and the solid state, are referred to the book, *Ice Engineering*, by Howard T. Barnes of McGill University (1928).

Prevention of trouble and service interruptions as a result of frazil ice has to start with the design of a plant. A long and deep pond, high head, permanent ice cover, and deeply submerged intakes are the most positive safeguards, but some plants may have to do without some or all of these. The first requirement is to dimension the racks so that in case of clogging they can take full water pressure without breaking. A completely clogged rack is bad, but to have parts of a broken one get into a turbine is worse.

The next requirement is that racks be designed so that they can be easily and quickly removed from the intakes. This means that they be built in units which are placed in slots in the intake piers like gates so that they can be handled like gates. Then, when frazil ice threatens, all or some of the racks can be removed. This leaves the turbines unprotected against floating trash, but during the time when frazil ice is a threat, river flow is usually below normal and the risk of trash not great, or less at any rate than the risk of getting units stopped by frazil ice.

Electric heating of racks has proven to be the most successful means to fight frazil ice. It is well known that the difference between frazil ice and no frazil ice is only a few hundredths of a degree in the temperature of the water. A relatively small amount of heat dissipated through the rack bars will create this difference and keep the racks free of ice. Successful electric rack-heating installations are found in a number of hydro developments in the United States and Canada and also in Sweden and Norway.



STEAM JET is efficient tool for removing spray frozen on gates and equipment.

TRASH RACKS ENCRUSTED with frazil ice are removed if complete clogging occurs.

Power consumption of such installations may be given in kw per sq in. of bare surface, per gross area of racks or per cu ft per sec of water going through the racks. It is evident that such figures are not directly comparable, but also that generally speaking the amount of current required is more or less proportional to the volume of water passing through racks. From this it follows that feasibility and economy of rack-heating installations decrease with decreasing head, that is, with increasing number of cu ft per secs required to produce 1 kwhr.

Data from a number of widely scattered locations indicate that power consumption of electric rack-heating installations is of the order of about 0.12 to 0.25 kw per cu ft per sec.

Electric heat applications mentioned so far are all based on producing heat by resistance. It is quite possible that, in the future, there will be an increasing number of installations where heating by induction will be used. Probably the first such installation has been made at Grand Coulee, where the spillway gate seals are kept from freezing by steel plates heated by induction coils. This installation is designed for a maximum load of 2,500 kw of heating current, or a little over 200 kw for each of the 11 drum gates, which are 135 ft long by 28 ft high.

Leadership of ASCE in Collective Bargaining Is Hailed

DURING THE PAST few months, two important steps have been taken in the field of collective bargaining for the professional man. They are:

Formulation of the National Professional Association of Engineers, Architects, and Scientists ("Civil Engineering," November 1946, page 480). This first national organization was conceived by ASCE men while in attendance at the Society's 1946 Summer Convention in Spokane, and had its initial discussion and independent preliminary organization meeting at that time and place.

Suggestion by ASCE President W. W. Horner that Local Sections appoint special committees to study collective bargaining at the local level, report to the Sections, and pass along to the national Society the constructive results of full discussions held on such reports.

In addition, there was the action by the Board of Direction at its Fall Meeting in Kansas City, adopting a labor policy calling for modifications in the Wagner Act and recommending adoption of a coordinated policy to Engineers Joint Council (CIVIL ENGINEERING, November 1946, page 511).

Even before these most recent developments, however, the program of ASCE had begun to attract the attention of others interested in this vital subject. For an "outside" view of this program, it is interesting to note what the *A.A.A.S. Bulletin*, published by the American Association for the Advancement of Science, has to say in its September 1946 issue.

Under the heading, "Engineering—Science, Industry, or Labor?" this publication declares that engineers "have drawn heavily upon the several fields of science without feeling any strong impulse to act jointly with scientists in the development of general scientific interests."

Then the article goes on to the subject of unionism and the professional man:

"Within the past 6 or 7 years the question of unionization of engineers in industry has arisen, and once again the profession is confused and disunited and—too often—uninformed and uninterested. Not long ago, a member of one of the regional engineering societies, following a long and varied experience in the labor field, offered his services to the organization for such use as its members might wish to make of them. The officials of the society lacked not only the wit to accept the offer, but even the courtesy to acknowledge it. More recently the American Society of Civil Engineers has become seriously concerned about the relation of its members to unions, and its Washington representative appeared July 10, 1946, before a subcommittee of the House Committee on Labor to testify on behalf of professional men in relation to labor legislation."

ASCE Presentation Cited

After citing the gist of the ASCE presentation before the House subcommittee, which asked for Wagner Act changes freeing professional men from forced unionism (see CIVIL ENGINEERING, August 1946, page 339), the article continues:

"Civil engineers are more often brought face to face with state regulation and with unions than engineers in other fields, and it is not surprising that their thinking has progressed somewhat farther along these lines. But electrical workers, mine workers, mill and smelter workers, oil field workers, machinists, agricultural workers are all partly organized. What is to keep electrical engineers, mining engineers, mechanical engineers, chemical engineers, or, for that matter, geologists, biologists, physicists, and chemists who do economic work, immune to the problems of unionization?

"There is, indeed, no reason why the civil engineers should face the situation alone among their professional colleagues, and no reason why the pure scientists, so-called, should bury their heads in the sand and hope the problem will bypass them.

"Organization has always had a practical objective—namely, the protection of workers' interests, which are usually defined as wages, hours, and working conditions. Where there is no need for protection, unions rarely thrive, though they may exist. It was during the depression that professional men first encountered the problem. Jobs were scarce and engineers were not. Such industries as the automotive industry discovered that they could hire engineers in drafting rooms and shops as cheaply as they could hire experienced draftsmen and mechanics without engineering degrees. Engineers thus hired found themselves treated, not as professional men, but like their co-workers who lacked degrees. During the war the phenomenal expansion of industry called for the creation of unwieldy supervisory staffs. Engineers in supervisory positions were soon outnumbered by men with no formal training and were treated the same way. Organization followed, and usually the engineers found themselves in small minorities within large bargaining units. Many highly trained scientists, notably in the fields of physics and chemistry, were involved in similar situations.

"Thus the need arose for the protection of the interests of professional men not only with employers but also with the unions, whose chief concern is with the non-professional worker. The academic scientists may be tempted to dismiss the matter as an evanescent problem in depression and in war, but he need merely refer to the reports of Committee A in the bulletins of the American Association of University Professors to learn that men in academic positions sometimes require the kind of protection that unions provide, and that some academic employers give every encouragement to their teaching staffs to organize in self-defense. The problem is with us and it will stay; therefore it must be met and solved with intelligence and insight. Professional men have too large a financial investment in their education and experience to ignore protection of interests for themselves or for those of their colleagues who may need it.

"The American Society of Civil Engineers has led, but it should not be left to work out the solution alone."

Studies Determine Economic Effects on Property Removed from Public Works Sites

JOHN S. WORLEY, M. ASCE

Curator and Chairman, Transportation Library,
University of Michigan, Ann Arbor, Mich.

CONSTRUCTION OF PUBLIC WORKS by the government during the next two decades will be quite large and the cost will run into hundreds of millions of dollars. Involved in this work will be the acquisition or removal of property, which at once gives rise to the question of economic effect upon its owners. As consulting engineer for the Ohio Division of the U.S. Corps of Engineers, the author of this article made extensive studies of the nature of benefits and damages to railroads resulting from public works construction. The information gathered from these studies is presented here for its application to similar situations.

REMOVAL OF RAILWAY or other property from reservoir sites may be accomplished in one of two ways—condemnation or agreement. The latter as a rule is preferable. The following discussion will generally be found to be applicable for either case. The relocation of railways in public works areas creates for these railways benefits and damages. Conclusions in these matters require knowledge of certain fundamental concepts of law and economics and fair dealing.

Removal of the railroad with all its parts and characteristics intact would be the ideal solution to the problem. The railroad in its new location would be identical with the old. It would be of the same length, have the same grades, curvature, rise and fall, cuts and fills, track and structures—the same physical condition as before relocation. That is to say, the relocated property would be the old property with no change. In this case, there would be neither damages nor benefits. But such a proposal is impracticable. The relocated railroad cannot be identical with the old. In order that there be no damages, the relocated property should at least be the economic equivalent of that taken for government property.

Benefits and Damages

The extent of the benefits and damages may be determined by the capitalization of the decrease or increase of operating expenses, or in some cases by actual expenditures incurred.

Benefits that may accrue to a railroad company whose property has been moved from a reservoir site to an adjoining location are of two kinds. They consist of those benefits that are incidental to the relocation and those that arise through changes or additions specifically requested by the railroad.

WHEN NEW STRUCTURES ARE REQUIRED on relocated lines, such as Social Hall Bridge on Pennsylvania Railroad Conemaugh Division shown here, usual practice is to figure depreciation on basis of old structure.

IF RAILROADS ARE EXPECTED TO PAY for benefits derived from relocated line which is shorter, has less curvature or less rise and fall, agreements are made in advance. Here construction work is begun on bridge for relocated line on Conemaugh Division of Pennsylvania Railroad.

A railway line, having been relocated and constructed in the most economical manner approximating the old line, may have certain characteristics such as less distance, less curvature, less rise and fall, and similar items that are incidental to the project. These are a benefit to the railroad. In this situation the railroad will probably look upon the incidental benefits as an advantage that it should be allowed to enjoy without any expense to itself. If it is expected that the railroad will pay for such benefits, agreements should be made in advance of the improvement.

Incidental Benefits and Damages

It is entirely possible that there may be certain damages to the railroad which could be classified as incidental, in which case they should be considered in part or whole as an offset to incidental benefits. If the incidental benefits exceed the incidental damages, the railroad will probably object to any contribution therefor; but should the amount of incidental damages exceed the amount of incidental benefits, the railroad will claim the full damage experienced, which the government will probably be called upon to meet.

The topography of a relocated line may be such as to permit curves of a lesser degree and a less amount (central angle) or a decrease in the rise and fall or a decrease in the length of the line, any one of which will bring about a decrease in annual operating expenses and will be a benefit. Wherever there is an increase in any of these elements, there will be an increase in annual expense, which operates as a damage to the railroad.

The largest investment in any single part of the railroad that is to be removed from a reservoir site to a new location is probably in the rails. The most satisfactory arrangement in this situation is for the railroad to furnish at its cost the rail for the relocated line, the old rail to remain the property of the railroad. In such an agreement, however, the cost of dismantling and removing the old rail to a designated storeyard should be borne by the government. In addition to the rail, the railroad should furnish all fastenings, except bolts and spikes, which cannot be recovered and used a second time.

Another item in which there is considerable investment is the tie system. By the very nature of track construction, it is not feasible to have the new track furnished with the old ties. These will have to be new at the cost of the government. Neither has it been found that any considerable amount could be recovered by the removal and sale of the old ties. The average condition of railroad ties in the United States seldom exceeds 60 percent. The depreciation of the old ties made good by new ties is a benefit to the railroad.

The cost of highway grade separations, where they are an addition to the property, should be borne jointly by the government and the railroad on the basis of the practice and laws of the respective states.

Depreciation

As a rule the structures on the relocated line will be new, even though they are a replica of the old structures, and will have a longer remaining service life, which is a benefit to the railroad.

The difference between the old and the new is often referred to as depreciation and it is common to represent this in the form of a percentage from which dollar values are determined. The question at once arises as to whether this value will be a percentage of the cost of the old or of the cost of the new. It is readily seen that there will be a great variation between the two. Or a situation may occur where a larger and more costly property, or the reverse, may be erected, which calls for most careful analysis. The railroad, as a rule, would prefer the existing to the relocated property, and is entering into the new arrangement with reluctance; therefore the depreciation on the basis of the old seems most fair. Whenever it can be done, old properties should be removed to the new site. By this process the question of benefits to the railroad because of new property will be entirely eliminated.

Tunnels are generally undesirable, hazardous, and expensive to operate. The removal of an old line to its new

location may eliminate one or more tunnels, which would be a decided benefit to the railroad. However, should the new location require tunnels not found on the old line, the reverse would be true.

During the first years of operation of the relocated line, the railroad will experience an increased cost of maintenance for which it should be compensated. Should all or some of the elements of the relocated line be new, it is reasonable to suppose that in some instances the cost of maintenance would be less for a brief period of time (five to ten years). Should the railroad contribute to the cost of the new structure an amount equaling the depreciation of the old structure, there would be no claim on the part of the government that the decreased cost of maintenance was a benefit to the railroad. However, it should not be overlooked that with the best type of construction the railroad will experience some increased cost due to adaptation of the new facilities to their functions.

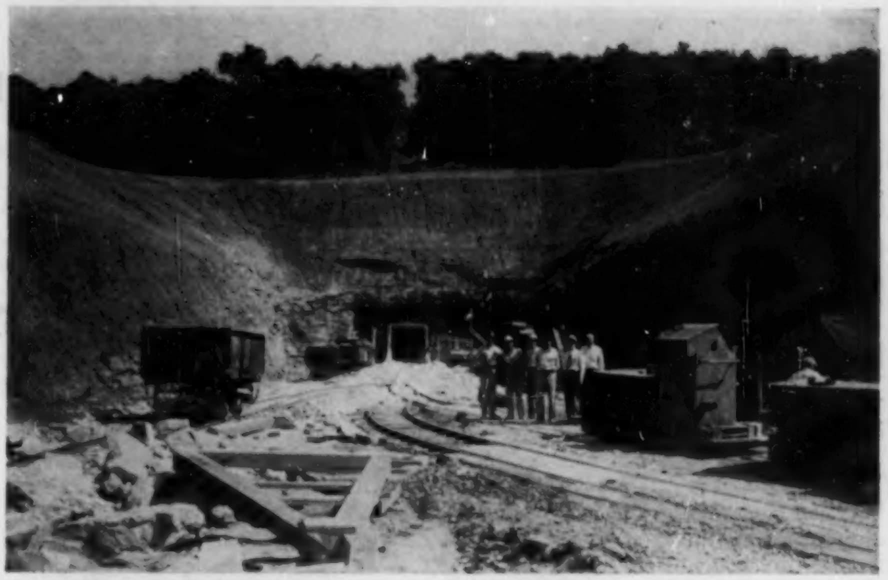
Economic Considerations

Through the years of operation of a railroad, there is continuous adaptation and solidification, which is of value in both the operation and maintenance of the property. The exact amount of this at any period in the life of a property is difficult to ascertain. However it is to be expected that the railroad will make a claim in some amount because of this.

The removal of a railroad from its present location to a new one may lead to the destruction or the abandonment of industry which in its operation furnishes traffic to the railroad, and therefore may result in the loss of traffic. The same would also be true when any city, village, town, or other settlement has to be abandoned or moved. Damages of this kind are consequential in nature; however court decisions are uniform in holding that such damages are not recoverable.

The foregoing calls attention to the principal items out of which benefits and damages may arise in the relocation of a railroad. Neither the discussion nor the list is complete.

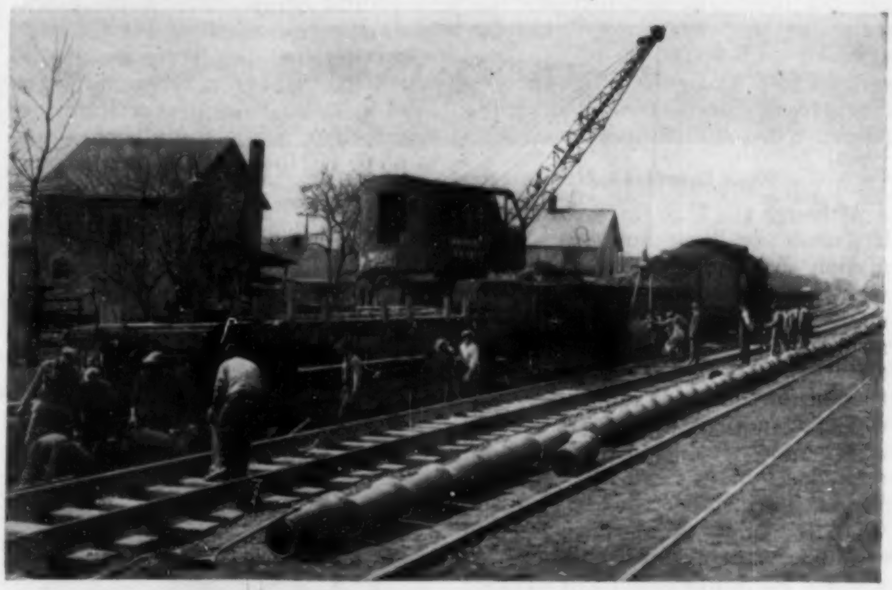
In the determination of benefits and damages, every situation should receive careful attention, since no particular one is like another. In each instance there should be a careful inspection of the property that is to be abandoned. The actual physical condition of property should be determined by statistical studies, and a careful field examination made before any final conclusion is reached.



RAILROAD RECEIVES PAYMENT for new tunnels required on relocated line and not found on old line, since tunnels are generally considered undesirable, hazardous and expensive to operate. Shown here is West Tunnel Portal on Conemaugh Division of relocated Pennsylvania Railroad line constructed in 1946. Photographs courtesy Corps of Engineers, U.S. Army.

As a rule this inspection should include an inventory of the property coming under various property accounts. Data sufficient to prepare reasonable and accurate estimates of costs should be taken. Each particular situation has specific benefits and damages.

Clay Pipe Replaces Clogged French Drains



EXTRA-STRENGTH CLAY PIPE used by B. & O. Railroad near Rittman, Ohio, is part of postwar improvement program providing safe, dry road, beds with adequate drainage systems. Here, crane mounted on flat-car-drawn by steam locomotive, digs trench with clamshell bucket. Clay pipe is placed and trench is backfilled with material stored in railroad car. This type of construction is replacing many French drains which have become clogged with soot and dirt. Combination of clay pipe and French drain permits water to collect in crushed-stone section to be carried off by pipe without danger of clogging and saturating subgrade.

Blasting Vibration Measurements Indicate No Danger to Green Concrete in Ross Dam

FRANK NEUMANN

Chief, Section of Seismology, Division of Geomagnetism and Seismology, U.S. Coast and Geodetic Survey, Washington, D.C.

TO DETERMINE THE EFFECT of blasting on the setting of green concrete a few hundred feet away—and the probable effect on the bond between the concrete and the adjoining rock—blasting vibration measurements were made at Ross Dam on the Skagit River, Washington. The U.S. Coast and Geodetic Survey and the City of Seattle Department of Lighting conducted the tests and published a report on their findings early this year.

Blasting of two 28-ft-dia diversion tunnels through solid granite, on the Lighting Department's project at Ross Dam, late in 1944, provided an opportunity for research in a field which has not been too thoroughly explored. The tunnels were being blasted as part of a plan to increase the height of the existing dam, but concrete on the addition to the dam had not been poured. Instrumental techniques for measuring vibrations have not yet been fully developed, nor is it yet fully known what constitutes a *dangerous* vibration, especially with reference to the setting of concrete.

More Data Needed

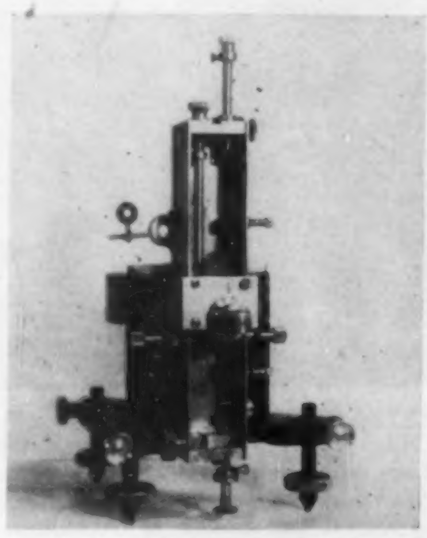
Although the U.S. Bureau of Mines has made available important information on the magnitude of blasting vibrations in Bulletin No. 442, "Seismic Effects of Quarry Blasting," the results show such a wide range of predictable values that for any particular type of foundation it is still desirable to make individual tests for precise information. In the publication quoted, a table of expectable displacements, for instance, states that the tabulated values for specified weights of explosives at specified distances (for average overburden) must be divided by ten for outcrops and multiplied by three for abnormal overburden (deep or sand-gravel-loam)

Vibration Meter Used

In acknowledging the Lighting Department's request to make the measurements at Ross Dam, the U.S. Coast and Geodetic Survey was aware that its instrumental equipment was not designed to measure the high-frequency waves to be expected in granite but it was agreed that the experiment would be worth while. The instrument found best adapted to this assignment was a Survey vibration meter which is essentially an inertia seismometer of the Wood-Anderson type.

The pendulum is a copper loop fastened to one side of the middle of a fine vertical wire drawn taut. Damping is magnetic. The natural pendulum period in this instance was 1.2 sec and magnification 1,200. Transverse vibration of the wire suspension partly controlled the response of the instrument at the high frequencies recorded but this was taken into account in calibration tests which were subsequently made on a high-frequency vibrator. Only the two horizontal components of the vibrations were measured.

In the Ross Dam operations, 700 or 800 lb of 60-percent dynamite were fired in 10-in. holes in a series of delayed shots. The initial core shots of 65 to 110 lb of powder were always the strongest of the series. Parallel tunnels had been driven several hundred feet into the granite at the time the vibration measurements were made. There were twelve observation points, two of which were in the tunnels on the left bank, six at various points on the granite rock on the left bank, and four in the dam itself. (See locations indicated in the accompanying photograph.) Distances from the instruments to the shot points varied from 150 to 1,450 ft, but only one was greater than 750 ft. Instruments were always sheltered. No records were made of air waves.



INSTRUMENT BEST ADAPTED to investigation is U.S. Coast and Geodetic Survey vibration meter, inertia seismometer of the Wood-Anderson type.

Observed Displacements

The greatest displacement, 0.0010 in., was recorded when the instruments were in an adjoining tunnel 154 ft from a 77-lb blast. Under reverse conditions, at 251 ft, a displacement of 0.0006 in. was recorded from an 87-lb blast. Two shots which checked very closely and served as representative values were 87-lb shots giving the following rock motions at 391 ft: Acceleration 13 percent of gravity, displacement 0.00038 in., and frequency 58 cycles per sec. The frequencies in the entire series varied from 30 to 90 cycles per sec. In some cases low values of displacement were coincident with higher frequencies so that the velocity, or energy factor, did not change appreciably from the average.

Displacements in the concrete dam were from one-half to two-thirds those measured in the granite wall at equivalent distances. On the average there was no outstanding change in the frequency of the dam vibrations nor was there indication of any outstanding oscillation of the dam in its own natural frequency. Tests made in the inspection tunnels indicated that the motion at the top center of the dam was several times greater than in the center base station, and that in the left gallery near the top of the dam and nearest the blasting, it was less than in the rock at the same distance.

While there was considerable consistency in the results obtained, the dispersion of the vibrations throughout the granite canyon wall was not generally uniform. There were changes in amplitude and frequency, due perhaps in part to the presence of fault surfaces and partly to the complexity of the vibrations themselves, which are made up of waves reflected from the outer surface of the rock, from various discontinuities, transformations of wave type, etc. In one instance when the charge was decreased from 77 lb to 23 lb, the displacement at 339 ft decreased from 0.00028 to 0.00008 in. The frequency however remained the same.

Results Are Substantiated

The results obtained are substantiated in a broad way by the figures reported in the Bureau of Mines Bulletin No. 442. The amplitudes, however, are generally less than would be predicted, but this is to be expected in view of the fact that the Skagit River granite is an outcrop of high density. The data indicate that the damping rate is considerably greater than it would be in average overburden.

On the basis of conclusions reached by the Bureau of Mines as to what amplitudes are dangerous, the results at Ross Dam indicated only a few vibrations in the base rock which would be in the lower range of the "caution" zone. This was substantiated by field inspections made by a consulting geologist of the Lighting Department, who found no evidence of dangerous vibrations.

Although the results indicate that the vibrations were in the "safe" range in so far as present knowledge is concerned, the data have considerable potential value in that the future behavior of the bond between the concrete and the granite can always by authentically associated with the type of vibration to which they were subjected during the period of construction.

FOLLOWING is a discussion by H. A. Coombs, associate professor of geology, University of Washington, Seattle, Wash. Mr. Coombs' remarks supplement those given above by Frank Neumann, who conducted the vibration investigations at Ross Dam.

IT IS IMPORTANT to keep uppermost in mind the original purpose of this investigation, which was to determine what effect the tunnel blasting would have on the dam, and especially what effect the blasting would have had on the concrete of the second step had it been poured at that time. To answer the first question—the report prepared under the direction of Frank Neumann, together with observations at the dam, seems to indicate that no apparent damage has been caused by the tunnel blasting.

Question of Effect on Second Step

The question as to what effect the blasting would have had on the concrete of the second step will have to remain a question. The intensity of the vibrations, however, would indicate that no damage would be expected. The conditions of the blasting on the first step, and the conditions of blasting on the second step, if it had been there, would not have been exactly comparable. The blasts would have been closer to the concrete if the second step had been in place. The dam would have been higher and thinner. The concrete may or may not have had longer to set than the concrete in the first step at the time of the blasting here discussed.

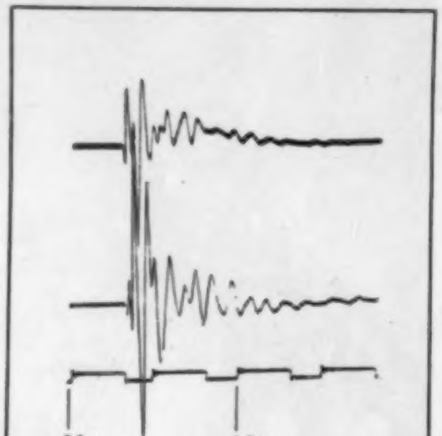
In spite of these various differences, the intensity of vibrations (as expressed in acceleration in percent of gravity) would probably not have exceeded 0.1 of gravity, which I believe is the theoretical safety factor for earthquake vibrations for this dam.

SEISMOMETER OBSERVATION STATIONS at Ross Dam are located as shown: (1) center of top of dam, (2) inspection gallery of dam, left bank, (3) Tunnel No. 2, (4) left bank, spillway approach, (5) test adit, left bank, (6) left bank, McGee Hill, (7) bottom center gallery of dam, (8) right gallery of dam, (9) Tunnel No. 1, (10) powerhouse site (not shown), (11) keyway rock (left abutment), (12) mixing plant.

Higher Intensities in Rock

In order to evaluate the results of the vibration studies in a slightly different light, a table was prepared to show the acceleration figures arranged in order of decreasing intensity. The first 32 observations in this table were from blasts in the tunnels and recorded *on the rocks* of the left bank or from very close keyway blasts recorded on the dam. The 33d is the first tunnel blast to be recorded on the dam. This has an acceleration of only 7.5 percent of gravity. In other words, most of the really significant figures in this vibration study apply to vibrations passing only through rock.

The blasts in the keyways of the left bank are exceptions to this statement. For example, observation No. 12 furnishes most of the figures for accelerations recorded on the dam above 7.5 percent of gravity. This case is worth stressing. The blast was set off in a keyway with 150 lb of powder, and only 64 ft from the recording accelerograph and vibration meters in the left gallery. Actually much of the powder was closer than 64 ft, the distance from the vibration meters to the center of mass of the blast. The dynamite was laid out in a pattern on a horizontal plane, and the closest sticks were almost under the vibration meters. Under such conditions rather large intensity figures would be expected. However, an inspection of the left side of the dam immediately after one of these blasts showed that there was no apparent damage. Drilling steel resting against the rocks was still standing, and piles of lumber nearby showed no effect.



TYPICAL VIBRATION METER READINGS reproduced here indicate blasting close to green concrete in dam does not endanger structure. Bottom curve shows time in fractions of seconds.

Higher Frequencies Less Damaging

Another point of special interest is the frequency of these vibrations. We are familiar with the damage done by earthquake vibrations of low frequency (usually less than 10 cycles per sec), especially when the acceleration is known. We are not familiar with the frequencies in the range of 20 to 80 cycles per sec in so far as the damage to structures is concerned. Data on this latter problem are very scant. Information gathered from laboratory experiments suggests that the higher frequencies (for given accelerations) are far less damaging to buildings and structures than the lower frequencies encountered during earthquakes.

Meager Experimental Data

In dealing with a subject of this kind the writer feels considerable humility. This type of study is new, field and experimental data are meager, and the significance of much of the information is very much in doubt. More reports of this kind will teach us much about the meaning and effect of vibrations.

Europe's Largest Suspension Bridge to Span Severn

TRAFFIC FROM ENGLAND to South Wales will soon cross the lower reaches of the River Severn on a 3,000-ft main-span suspension bridge—Europe's largest—relieving congested traffic conditions further north and permitting South Wales, a coal mining center, to develop industrially. The proposed bridge will replace a ferry—whose predecessors date back 2,000 years—linking Beachley, England, with Aust in Wales.

The new bridge is to be a four-lane structure designed to carry 4,000 vehicles per hour. End spans of 1,000 ft give the bridge an overall length of 5,000 ft between anchorages. Vertical clearance provided for shipping will range from 110 ft above high tide, near the 450-ft-high steel towers, to a maximum of 120 ft at the center of the main span.

Included in the project are plans for the construction of approach roads on either side of the bridge, and a bridge over the River Wye. The entire project, including approach roads and bridges which total about 8 miles in length, will cost about $30,000,000. The new Wye Bridge is to have six spans of 150 ft, two of 175 ft and a central span of 200 ft.

British Information Services.

Engineers' Notebook

Digester Scum Controlled by Liquor Recirculation

HARRY E. SCHLENZ, ASSOC. M. ASCE

Vice-President, Pacific Flush Tank Company, Chicago, Ill.

CONTROL OF SCUM on sewage-sludge digestion tanks can be accomplished by recirculation of digester liquor into the scum zone. The practice among plant operators of separating out grease and other scum-forming materials and disposing of them outside the digestion system is therefore unnecessary and even undesirable. Actually the digester is the ideal place to dispose of greases and scum, and the emphasis should not be placed on the difficulties encountered with scum accumulations, but rather on the benefits that may be derived from this material as far as gas production and composition of the gas are concerned.

In any digester where raw solids are added, scum will tend to separate and form at the top of the tank. As long as this scum does not exceed a foot or two in depth, and is of a soft consistency, there is good indication that it is undergoing normal digestion. In digestion systems receiving an abnormally high loading of raw solids, scum may build up quite rapidly and may seriously affect the digestion of the solids in the rest of the tank by reducing the volume available for active digestion.

Greases are readily digestible and result in a higher percentage reduction of volatile content than the rest of the solids in the digestion system. It is therefore evident that if proper conditions are provided in the scum mass, it is possible to promote rapid destruction of the fats and soaps present by digestion. In this process lower fatty acids form first, and digest further to produce methane and carbon dioxide.

Liquid Saturation Important

Scum accumulations should be kept in intimate contact with the liquid contents of the digester, which contains active organisms to promote the desired rapid digestion. This may be accomplished by positive submergence or by recirculation of digester liquor. In practicing liquor recirculation, it has been found neither necessary nor desirable to discharge the recirculated liquor into the scum with any appreciable force. Best results have been obtained by discharging at one point in the tank, such as the center of the gas takeoff dome, at the top of the scum layer. The rate of discharge should be such as to recirculate the contents of the upper two-thirds of the digester in from 24 to 48 hours.

Observations made over an extended period of time in connection with scum control in the digesters of a large Naval installation, indicate the success of this method. Before scum-control measures were started, each of two 65-ft-diameter digesters contained about 9 ft of yellow sickly looking scum, which had become so concentrated that it could not be penetrated with a two-by-four. Digester liquor, recirculated at a rate of 300 gpm by a self-priming centrifugal pump and piping, arranged as shown in Fig. 1, caused the following action. First the area of the scum mass immediately adjacent to the relatively gentle discharge of the recirculated liquor became soft and mushy; then large masses of scum, resembling a firm fresh cheese, gradually moved from the under side of the floating cover towards the gas dome and broke off in large chunks as they became softened. After a few days it was evident that the entire scum mass was of a soft mushy consistency, completely permeated with the digester liquor.

In new installations and in some remodeled digester systems, recirculation is provided by a fixed piping system. Pump suction is taken from one or more points in the digestion tank at about mid depth, and the discharge is carried into a vertical pipe terminating at the normal high liquid level of the tank at the center of the gas dome, as shown in Fig. 2.

Records of digesters characterized by excessive scum accumulations reveal temperatures in the scum zone considerably lower than those in the rest of the digesting mass. This condition is not conducive to digestion. Liquor recirculation tends to provide the desirable temperatures for digestion in the scum zone. It is possible by providing external heating to raise the temperature of the recirculated digester contents, and thus greatly to increase the rate of digestion of the scum by discharging the warmer liquor on top of the scum, as shown in Fig. 2.

It is desirable to lessen or eliminate entirely the tendency of scum-forming materials to separate from the raw solids as they are added to the digestion system. This may be accomplished by adding the raw solids to the recirculated digester contents and then heating the mixture, so that the sludge, on first entering the digester, is properly seeded and heated to the optimum temperature and completely dispersed.

In a number of digester installations where especially heavy scum accumulations have been encountered,

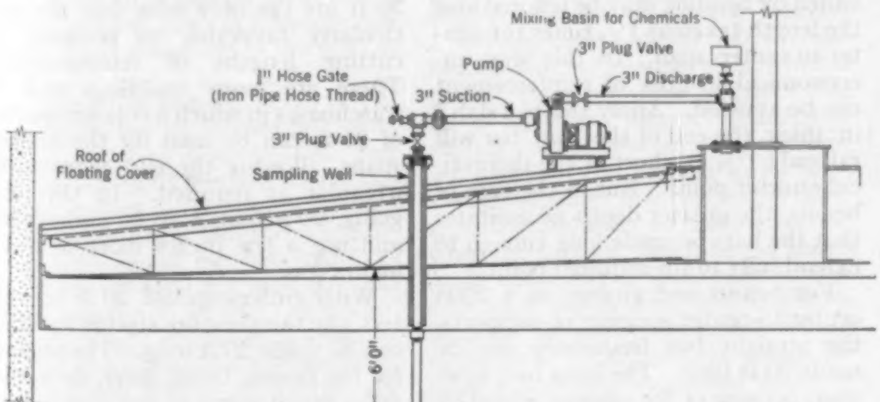


FIG. 1. **PIPING ARRANGEMENT provides for recirculation of digester liquor through scum.**

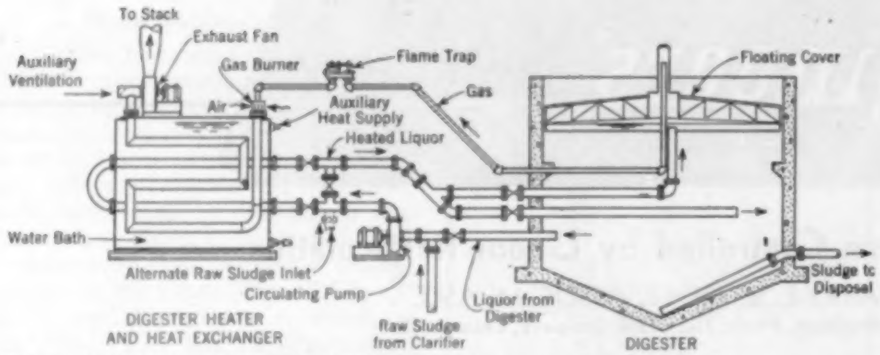


FIG. 2. **HEATER FOR DIGESTER LIQUID** combines action for control of scum.

another expedient has been found effective in causing the scum to digest quite rapidly and disappear. This is the addition of relatively small amounts of an ammonia-nitrogen compound to the liquor circulated to the scum zone. Ammonium sulfate may be used as the source—the commercial product yielding about 25.6% of ammonia nitrogen. This ammonia salt is easily handled, readily soluble in an equal weight of water, and obtainable at a low cost.

It is added in relatively small doses of 50 to 100 lb, with continuous liquor circulation between doses. Additions are made until about 30 ppm of equivalent ammonia nitrogen has been added to the volume of the tank being recirculated, normally assumed to represent one-half to two-thirds of the tank contents.

It has been found that if the ammonium sulfate is added too rapidly, there is a tendency for activity in the scum zone to reach such proportions as to resemble a "foaming" condition. Continued addition of the salt to give an excessive concentration of ammonia nitrogen in the digester may also be detrimental to the digestion of the scum solids.

Editor's Note: This article is taken from a paper presented before the New England Sewage Works Association and is printed with the permission of the Association.

Column and Beam Spacing Considered for Economy in Steel Bar Lengths

C. L. DAYTON, M. ASCE

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IN reinforced concrete buildings, certain column spacings are better than others from the point of view of economy in the steel reinforcement. Because of the shortage of this material at present, the companies that furnish the steel must make the most of their limited supplies.

Reinforcing bars are carried in stock in lengths of 60 ft. The bar companies now can and must favor orders in which the bars may be cut from 60-ft pieces with as little waste as possible. In addition to waste prevention, less handling results if the bars called for are in lengths of 30, 20, 15, 12 ft, etc. As a negative example, in order to cut 10 tons of bars 30 ft 3 in. long, the shop must handle approximately 20 tons, and some 10 tons of an odd length will be left in the warehouse.

Avoiding Waste in Reinforcement

With a spacing of columns at 20 ft, many of the bars required will be in lengths that can be cut from the 60-ft pieces without waste. Consideration is here given especially to beam-and-slab construction, but the following comments apply to other types of construction as well. If the beams are spaced at 10 ft on centers, the straight bars in the slab will be 10 ft long; and the bent bars, if they are extended approximately to the quarter points of the adjacent spans, can be made 15 ft long. Spacing the beams at 6 ft 8 in. gives a straight bar of 6 ft 8 in. and a bent bar of 10 ft. A beam spacing of 5 ft is equally good. All these bars can be cut without waste.

Making Allowance for Bending

In reinforced concrete beams and slabs it is common practice to extend the bent bar past the center line of the support a distance equal to a quarter of the span. This means that the bent bar for an interior span will, if the spans are uniform, have a length of $1^1/_2$ times the span plus the amount added by the bending of the bar. In thin slabs the amount added by bending may be ignored and the length taken as $1^1/_2$ times the center-to-center span. In this way uneconomical lengths of reinforcement can be avoided. Apply this to a slab 5 in. thick, the end of the bent bar will fall only $1^1/_4$ in. short of the theoretical quarter point. But in the case of beams, the greater depth necessitates that the bars be made long enough to extend fully to the required point.

For beams and girders on a 20-ft center-to-center spacing of supports, the straight bar frequently can be made 20 ft long. The bent bar, however, because of the amount added by bending, would be too short if only 30 ft long. But this is the only item that would be bad. If the reinforcement system for beams and girders is such that only straight bars are employed, good lengths of all bars are obtained. Not only will the bottom bar have a length of 20 ft, but the top bar if carried to the quarter points of the spans will have a length of 10 ft.

By using the straight-bar reinforcement system just mentioned, columns can be spaced at 30 ft and beams at 10 ft. With this, a layout of girders, beams, and slabs can be made that will permit all lengths of reinforcement to be cut from 60-ft bars.

Spacing Columns for Economy

These column spacings of 20 ft and 30 ft are the only ones that are particularly favorable to economy in cutting lengths of reinforcement. There are many buildings such as warehouses in which a column spacing of 20 ft can be used for the interior spans, allowing the end spans to be irregular as required. In the foregoing, 20 ft 0 in. is to be understood, and not a few inches more or a few inches less.

With girders spaced 20 ft on centers, the temperature steel in the slabs can be made 20 ft long. The stirrups for the beams, being short, do not involve much waste in any case and do not need special consideration.

... THE READERS *Write*

Should ASCE Be Purely Professional?

Indicative of the growing interest in collective bargaining among professional engineer employees, and the part played by the Society in questions of national importance to its members, are the two letters published here. Comments on these and other problems with which members of ASCE are faced are welcome in these columns.—Editor.

Member Opposes Society's Interest in Economic Status

DEAR SIR: This is, first of all, to express my appreciation of President Horner's keen interest in the welfare of the membership of the American Society of Civil Engineers and of the brilliant addresses he has delivered since he became president. Secondly, I wish to comment on one aspect of his last address delivered at Kansas City, which was published in the November issue, page 481.

At the outset of this address he states: "Probably the thing that has impressed me most deeply is the apparently endless succession of problems which the engineering profession, and our branch in particular, is having to face and the *appallingly small proportion of our membership* that is actively engaged in attempting to solve them."

With this phrase which I have italicized he unintentionally gives the reason why every attempt of the Society to serve its members in the economic field, in the past as at present, has been disappointing to a large number of salaried engineers. No doubt this very reason causes the disease of smallness to be chronic, since the majority of the membership is made up of salaried engineers. I offer my personal views as a contribution towards the improvement of this state of affairs.

My connection with the Society is relatively recent, but my interest in it dates from the first week of my freshman year in college (1924). From that time to this date my interest in the Society has been and still is due to its publications and the caliber of its leading members, and I believe this is the main and most powerful interest common to all who join the Society, which is, I emphasize, a source of technical information and a stimulus towards attaining professional prestige, not economic or financial standing, except as an incident to professional advancement.

If the Society is to endeavor to solve an "endless succession of problems," this endeavor will only divide the membership into groups of opposite interests. I, for one, disapprove the ASCE classification and compensation plans, past and present, the labor policies, and the setting up of bargaining agencies disarmed of striking power. The Society is not serving progress by attempting to segregate salaried engineers from the rest of labor, regarding the latter as "untouchables," when the engineer should be the one to guide unions out of their objectionable features. The question, "Should Buddha go to the mountain or the mountain come to Buddha?" is very old, but unique because it has only one possible answer.

The Society cannot organize bargaining agencies without inviting dissension because its leading and most influential members are employers, or otherwise have more interests in common with the employer than with the employee.

The most effective bargaining agencies are labor unions since they carry the strength of numbers and have a long acquired experience in the use of bargaining methods.

In conclusion, let the Society remain active in the technical field, where all of its members are ardently interested; relegate matters concerning the economic status of the engineer to the background or cooperate with labor, which is, of course, incompatible with the interests of the leading members of the Society.

G. F. RAMIREZ, Assoc. M. ASCE
New York, N.Y.

Material Well-Being of Members Called Worthy Aim

DEAR SIR: As a possible member in the category of "leading and most influential members" to whom he refers (assuming that a Vice-President can be classified as a leader with some influence in the Society), I have read with great interest the adjoining letter of G. F. Ramirez, Assoc. M. ASCE. It is not as a national officer of ASCE, however, that I should like to comment upon the letter. I write here as an employee engineer—one whose professional outlook and economic and financial standing are affected by the same influences as those of Mr. Ramirez.

First of all, I should like to state that I agree wholeheartedly with Mr. Ramirez that the Society interests most members because it is "a source of technical information and a stimulus toward attaining professional prestige, not economic or financial standing, except as an incident to professional advancement." The constitution of ASCE cites among its objectives the "advancement of the sciences of engineering and architecture in their several branches and the professional improvement of its members," and also "the establishment of a point of reference and union for its members." It still is devoted to those aims. But that does not mean the Society must confine itself solely to the purely professional phases of life. To do so today, in the face of agressive and demoralizing unionization efforts, some of which project themselves even beyond the law, would indeed be negligent.

While it is true that "man cannot live by bread alone," it is equally true that he must have bread in order to exist and be able to manifest and maintain interest in the purely professional aspects of his life. As chairman of the Society's Committee on Employment Conditions, I am well aware of the ever-present threat of trade unionism to professional engineers who seek little more than to be left alone to pursue peacefully their professional interests.

It strikes me that Mr. Ramirez misses the point entirely when he forebodingly anticipates that the Society, by including in its activities an active, direct interest in the economic and financial welfare of its members, "will only divide the membership into groups of opposite interests." Nothing could be further from the objectives or the present policies of the Society. I judge that the "division" Mr. Ramirez has in mind is the setting off of an employer group against an employee group within the membership of the Society. I find nothing in the Society's program to date to warrant such a fear. The program has been one of educating its members with the specific intention of further-

ing the interest of engineering employers and employees alike. It is very significant that throughout the history of this development the succeeding Boards of Direction have contained a large percentage of employers as well as of employees.

I do not believe that Mr. Ramirez has a full appreciation of the implications of his suggestion that professional employees join labor unions for purposes of collective bargaining. In the first place, the attitudes, abilities, and work characteristics of a professional man just are not susceptible to standardization and regimentation in accordance with labor union criteria. It is a fundamental of unionism that quantity of work and pay shall be standardized. This means that all, whether expert or inept, must be held to some standard of production and, obviously, the standard must be at some low or mediocre level if it is to be within reasonable reach of all. Quite to the contrary, the aim of professionalism is superiority of production. The genius and abilities of creative artists or professional engineers are no more susceptible to regimentation than are the birds of the air or the flowers of the field.

Therefore, the objective of the Society's program is to make it possible for professional employees who wish to bargain collectively to do so through bargaining units composed solely of professional employees. I hold that to be a sound and worthy objective.

This program as well as the adoption of the classification and compensation plans and the labor policies of which Mr. Ramirez "disapproves," and the Society's efforts to keep its members posted on how true professionalism may continue to exist under present labor laws as administered, are prompted by a sincere desire to sustain our profession in its traditional dignity among employers and employees alike in combating enforced collectivism. The Society is not now "setting up bargaining agencies," nor has it ever done so. In fact, it has always remained aloof from such organizational activities. Such procedures are left entirely to employee members acting in collaboration with fellow professionals in such manner and at such times and places as they themselves deem necessary.

All the Society has done, and all it intends to do, in so far as I understand its policies, is to strive to preserve to the engineering profession the complete freedom of thought and action which are first requisites for the professional advancement we all regard so highly.

This somewhat tardy effort toward direct betterment of the economic status of all its members, in my opinion, will not result in dividing the Society into two dissident groups. If pursued aggressively, it will serve to unite all engineers against the insidious encroachment of powerful and selfish interests which, if successful, will transform the practice of engineering from the status of a profession to that of a trade. The activities of ASCE in the interests of member welfare appear to me to be a major step forward toward accomplishment of one of its principal constitutional objectives, the establishment of a more perfect union among its members.

GAIL A. HATHAWAY, M. ASCE
Washington, D.C.

Spillway Design to Facilitate Repairs

DEAR SIR: With reference to the article in the September 1946 issue of CIVIL ENGINEERING, entitled: "Unique Caissons Make Spillway Repairs Possible at Grand Coulee," I wish at this time to make public some suggestions I made through our office in February 1945, and which drew some interesting comments from my fellow engineers.

The excerpts follow:

"As is known, the fact of erosion of the downstream face of the spillways of some of our recently constructed dams—which extends well into the stilling pool itself—confronts us with periodical maintenance repairs of that portion of the downstream part of these structures. This suggestion is to deal only with a more expedient and efficient way to make these periodical inspections and repairs and does not offer a definite cure for this wearing out of concrete bucket and apron.

"I propose to incorporate in all future designs of spillways (similar to Bonneville or Grand Coulee design) a series of training walls (possibly as an extension to the main piers) which will continue down into the bucket with the elevation of the top of the wall above the elevation of the tailwater.

"At the downstream ends of these walls, vertical slots will be provided to receive stop logs or temporary gates, as the case may be, and also a bridge or crane-way running all the way across will be provided. In case of a bridge (which seems to me more of a practical suggestion), the stop logs may be brought by a truck and lowered in place by a movable derrick or a power shovel. Then each separate trough, thus formed, may be drained and pumped out and inspection or repair work may be started on one or even a series of these areas thus exposed.

"This scheme has the advantages of flexibility and independence of the river and seasonal conditions, and provides complete control of these maintenance repairs.

"Developing this idea even further, several of these separate spillways may be turned into an experimental project on a full scale, employing different materials or even different design features, which over a period of time will give positive results as to the most practical method or materials of construction to be employed. The rest of the spillway surface may be left lower than the final finished outline and a temporary heavy timber wearing surface may be provided, to be substituted or refinished later in a way found the most expedient. The results of this experiment on a true scale can never be approached in the hydraulic laboratory, which has been proved by the unpleasant surprises at Bonneville, and to a even greater extent at Grand Coulee Dam.

"Among the materials worth trying, heavy timber decking may have some promising features. Granite blocks or heavy slabs have been employed on some of the European dams. Also, we may have a great amount of airplane runway steel grating available after the war, and perhaps this superfluous material might be very useful as a wearing surface.

"It seems to me that the additional cost of this feature, being only a small part of the original large investment, will very well pay for itself in both speed and economy in performing these unavoidable repairs in years to come."

M. P. SELIVANOFF
Structural Engineer, U.S. Army Engineer Office
Seattle, Wash.

Members Held Accountable for Welfare of Juniors

TO THE EDITOR: It has been correctly said that if all the past work of engineers and scientists were wiped out today, the world would be back in barbarism tomorrow. It is interesting, then, to ask why so many of these men, who are the brains without which our civilization could not function, receive only financial compensation comparable with the wages of unskilled labor.

A student of the subject has said that when he found a badly paid engineer, it was invariably another engineer higher up who was holding down the subordinate's salary. An executive of a concern employing many engineers told the writer that he never interfered in matters of engineers' salaries, as they were decided by the manager of engineering—an engineer with much experience in such matters.

Some years ago the directors of research for two of the most important engineering concerns in the United States stated—in addresses before one of the national engineering societies—that it was inadvisable to pay high salaries to research engineers as the money tended to distract their attention from their work.

The standards of ethics of the legal and medical professions have been frequently criticized. But we rarely hear of a member of either of these two professions assisting in beating down the fee of another member when such fee is to be paid by a third party. In a recent ASCE discussion, at which some of the older Members of the Society were trying to formulate a code of ethics for the Juniors, the writer suggested that, as he had never known a junior engineer to act except in accord with a high standard of ethics while he had only too often seen older engineers sacrifice their standards, it was perhaps presumptuous for the older men to attempt to lecture the juniors on ethics.

If the salaries of engineers and scientists were increased several times their present amounts, they would be more in accord with the importance of these men's work. Furthermore, if this were done, the resultant added burden on the national economy would be less than one-quarter of that resulting from increases in the wages of labor since 1939. One of the important obstacles to be overcome before this can be accomplished is the attitude of the older members of the profession.

W. L. WATERS, M. ASCE
Consulting Engineer

New York, N.Y.

Solution Suggested for Three-Point Problem

TO THE EDITOR: It has been said in CIVIL ENGINEERING that the search for a convenient method of solving the three-point problem has a periodicity of thirty years. In the hope that there is still interest in the subject, I am presenting the solution we have devised in the office of the Morrison Engineering and Surveying Company. This is based on the principle set forth by George F. Nechwort, Jun. ASCE, in the February 1946 issue (page 73). For convenience I have used the same hypothetical problem used

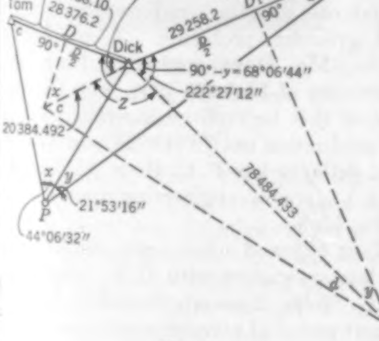


Fig. 1.

by R. M. Wilson, M.ASCE, in his article in the same issue, page 72.

It is imperative that methods used in the smaller engineering office be rapid as well as accurate, as no appropriations are made for research or the use of extensive and involved formulas. Thus we are using many radical methods in engineering and surveying calculations, of which this particular problem is one. Our work necessitates closures to three places in all instances with even closer precision as the problem requires—for instance, intersections of lines with parabolas or parallel parabolas; computation of areas; balancing of surveys; vertical curves, etc. For all these problems we have found quicker methods of solution and they have become mere routine.

For the three-point problem the solution is found in three simple triangles—two right triangles and one oblique triangle—as shown in the accompanying Fig. 1. In all three-point problems certain factors must be given, as shown in the sketch. The figures are those actually used in the solution for presentation; otherwise fewer would be needed, as in actual office work some of the totals are carried in the machine. As our entire work is based on the coordinate system, either assumed or real, our final check is by that method. However, for those who are not accustomed to it, the proof here shown may be employed, which takes about 5 extra minutes.

A decided advantage to this solution is that once it is understood it can be solved easily and rapidly by longhand or logs in the field without referring to formulas.

A question will arise regarding this solution when the angle Z becomes acute or overlaps. Simply by sketching the problem it will be clear which angles equal each other and which supplemental angles opposite are equal. Such conditions seldom arise and do not lend to accurate work in the field.

WILLIAM W. POLLARD
Morrison Engineering and Surveying Company

Santa Ana, Calif.

$$Z = 108°\text{-}27'\text{-}00''$$

$$\frac{180° - Z}{2} = 35°\text{-}46'\text{-}30''$$

$$\frac{D_1 + D = 98{,}868.925}{D_1 - D = 58{,}099.941} = \frac{\overset{(0.72055966)}{\tan 35°\text{-}46'\text{-}30''}}{x}$$

$$x = \tan\,(0.423434094) = 22°\text{-}56'\text{-}58.04''$$

$$c = 58°\text{-}43'\text{-}28.04'' = \text{Tom};\quad d = 12°\text{-}49'\text{-}31.96'' = \text{Harry}$$

—PROOF—

$$\frac{\overset{(0.69602420)}{\sin 44°\text{-}06'\text{-}32''}}{\underset{\substack{(0.85468050)\\ \text{(Tom)}}}{\sin 58°\text{-}43'\text{-}28''.04}} = \frac{28{,}376.2}{\underset{\substack{34{,}844.456\\ \text{(Dick to P)}}}{x}}$$

$$\frac{\overset{(0.37278985)}{\sin 21°\text{-}53'\text{-}16''}}{\underset{\substack{(0.22198323)\\ \text{(Harry)}}}{\sin 12°\text{-}49'\text{-}31.96''}} = \frac{58{,}516.4}{\underset{\substack{34{,}844.456\\ \text{(Dick to P)}}}{x}}$$

Factor of Safety Equation Discussed

DEAR SIR: Professor D. M. Burmister's proposed safety factor equation, as presented on page 315 of the July issue, has produced some interesting discussions, in which most of the writers take more or less for granted the actual significance of a factor of safety. To me, a factor of safety is really a factor of doubt about one of more of the basic data of a problem. The doubtful data may pertain either to the strength of the structural member under consideration, or to the loads to which it is subjected, or to both.

It is submitted that the factor of safety should be referred to the doubtful quantity, which in the case of an earth dam slope is the shearing resistance of the material, c, or $c + \Sigma N \tan \phi$. In other words, Professor Burmister's Eq. 1 would seem to be preferable. If we were reasonably sure of the shearing resistance but doubtful of the values of W_1 and W_2, then Professor Burmister's Eq. 4 would apply.

It is true that there is room for doubt as to the values of W_1 and W_2, since we are not sure that the dangerous circle is the most dangerous arc of failure, but the doubt as to the shearing resistance is greater in most cases.

The analogy quoted by Mr. Bergman in the September issue, page 404, illustrates this. If we are not sure of the weight of the anchor, then the factor of safety is infinite, because no matter how small the anchor, overturning will not occur. If we are not sure of the value of W_1, then the factor of safety is 1.5, because a 50% increase in W_1 will produce overturning.

J. S. KENDRICK
Dist. Engr., Water Rights Branch, Dept. of Lands and Forests

Victoria, B.C., Canada

SOCIETY NEWS

Society Prizes and Medals to Be Awarded

Eight Members to Be Honored at Annual Meeting for Outstanding Papers

PRIZES AND MEDALS will be presented by the Society at its Annual Meeting in New York City, January 15–18, 1947. Oldest and most notable of these awards is the Norman Medal, established in 1872 by the late George H. Norman, M. ASCE, for an original paper that is considered an especially important contribution to the profession. The award considered next in point of distinction is the J. James R. Croes Medal, which was established by the Society in 1912 and named for the first recipient of the Norman Medal.

The late Thomas Fitch Rowland, Hon. M. ASCE, endowed the prize bearing his name in 1884. This award is given for a paper that best describes in detail some accomplished construction work. In 1912 the Society established the James Laurie Prize, which was named in honor of the first President. This prize goes to a paper that is considered second in merit to that awarded the Thomas Fitch Rowland Prize.

The Arthur M. Wellington Prize for the best paper on some phase of transportation was established and endowed by the *Engineering News-Record* in 1921. Although the recipient of this prize need not be a member of the Society, its award rests with the Society.

In 1894 the Collingwood Prize for Juniors was established by the late Francis Collingwood, M. ASCE, on his retirement as Secretary of the Society. Papers eligible for this award must describe an engineering work or record an important investigation with which the author has been connected. Excellence of style is also a governing factor in the selection of the paper receiving this prize.

The J. C. Stevens Award, which was established in 1943, is given annually to the member of the Society submitting the best discussion of a paper in the field of hydraulics published in TRANSACTIONS. The award, which is made on the recommendation of the Hydraulics Division, consists of books costing not more than $50, to be selected by the recipient.

In 1939 A. P. Greensfelder, M. ASCE, endowed the Construction Engineering Prize. Although this prize is awarded on advice of the Construction Division, it is different from the other Division prizes in that it is the only award specifically limited to material appearing in CIVIL ENGINEERING.

Biographical sketches of those receiving prizes or medals follow.

KARL TERZAGHI

KARL TERZAGHI, an authority on soil mechanics, is the recipient of the Norman Medal for the third time, having won it previously in 1930 and in 1943. Born in Prague, Czechoslovakia, Dr. Terzaghi was graduated from the Technische Hochschule at Graz, Austria, in 1904. From 1905 to 1914 he worked in various capacities, mostly as superintendent of construction on jobs in Austria, the Balkans, northern Russia, and the western part of the United States. From 1914 to 1916 he served as a first lieutenant in the air corps of the Austrian Army.

In the latter year Dr. Terzaghi became professor at the Imperial Engineering School at Istanbul, Turkey. He remained there until 1918, when he exchanged his position for a similar one at Robert College (an American institution) in Istanbul. He was at Robert College until 1925, supplementing his practical experience with foundations by extensive experimental research, the results of which were published in 1925 in a book entitled *Erdbaumechanik*. From 1925 to 1929 Dr. Terzaghi continued his teaching activities at the Massachusetts Institute of Technology.

In 1929 he accepted a professorship at the Technische Hochschule in Vienna and remained there until 1938. During these years he was a consultant on a hydroelectric development, Swir III, in northern Russia; on various irrigation projects in Central Asia and Transcaucasia; on the construction of rockfill dams in Algiers; and on numerous other structures in the Eastern hemisphere. Harvard University invited Dr. Terzaghi to lecture on soil mechanics in 1936, the year of its tercentenary celebration. In that year the First International Conference on Soil Mechanics met at Harvard, and Dr. Terzaghi served as its president.

Resigning his professorship in Vienna in 1938, Dr. Terzaghi was appointed lecturer in the Harvard Graduate School of Engineering. From 1938 to 1941 he also acted as consultant on soil mechanics in connection with the building of the Chicago subway, and in 1941 he was employed by the Dravo Corp., of Pittsburgh, on the construction of two drydocks at Newport News, Va. During the past few years he has served as consultant on numerous construction jobs in the United States, Mexico, Canada, and Sweden.

He is at present member of a board of consultants for a reclamation project in India. Dr. Terzaghi was recently appointed professor of the practice of civil engineering in the Harvard Graduate School of Engineering, and he is also lecturer and research consultant in civil engineering at the University of Illinois.

Dr. Terzaghi is the author of *Theoretical Soil Mechanics*, and co-author of books on soil mechanics and of a book on engineering geology. He is a member of the Institution of Civil Engineers (James Forrest Lecturer for 1939) and of the Boston Society of Civil Engineers (Desmond FitzGerald Medal). He has been a Member of the Society since 1927.

GAIL A. HATHAWAY

GAIL A. HATHAWAY, special assistant to the Chief of Engineers, Office of the Chief of Engineers, Washington, D.C., is the recipient of the J. James R. Croes Medal. Official nominee for Vice-President of the Society from Zone II, Mr. Hathaway is at present completing the unexpired term of Vice-President A. C. Polk, who died in March 1946. Mr. Hathaway's biography appeared in the "Society Affairs" section of the December 1946 issue of CIVIL ENGINEERING.

JAMES B. HAYS

JAMES B. HAYS, recipient of the Thomas Fitch Rowland Prize, is the author of numerous papers on foundation and grouting problems. A native of Idaho, Mr. Hays graduated from the University of Idaho in 1911, with the degree of B.S. in civil engineering. From his graduation until 1919, he was associated with the late F. C. Horn, M. ASCE, in a a general engineering practice at Boise, Idaho.

Then followed a few years on drainage work in association with M. R. Lewis and W. G. Sloan, Associate Members ASCE; a short period of private practice in Boise; and several years as designing engineer for

KARL TERZAGHI
Norman Medal for Paper, "Stability and Stiffness of Cellular Cofferdams"

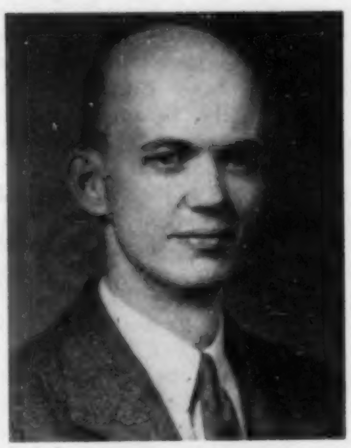
GAIL A. HATHAWAY
J. James R. Croes Medal for Paper, "Military Airfields—Design of Drainage Facilities"

JAMES B. HAYS
Thomas Fitch Rowland Prize for Paper "Unusual Cutoff Problems—Deep Solution Channel, Kentucky Dam, Kentucky"

L. A. SCHMIDT, JR.
James Laurie Prize for Paper, "Unusual Cutoff Problems—Flowing Water in Underground Channels, Hales Bar Dam, Tennessee"

JAMES H. STRATTON
Arthur M. Wellington Prize for Paper, "Military Airfields—Construction and Design Problems"

C. O. CLARK
Collingwood Prize for Juniors for Paper, "Storage and the Unit Hydrograph"



JOHN S. McNOWN
J. C. Stevens Award for Paper, "Lock Manifold Experiments"

GEORGE K. LEONARD
Construction Engineering Prize for Paper, "Lining the Eight-Mile Apalachia Tunnel"

the late A. J. Wiley, M. ASCE. In April 1926 Mr. Hays joined the engineering department of the Aluminum Company of America as resident engineer on the Santeetlah and Calderwood power projects in North Carolina and Tennessee. On completion of these projects, he was transferred to the Pittsburgh office of the company for designing work in the hydraulic department. This work included designs for the remodeling of the Smithfield Street bridge, which was rebuilt with an aluminum floor.

From 1934 to 1936, Mr. Hays was with the U.S. Bureau of Reclamation in charge of special grouting problems, particularly the filling of the contraction joints at Owyhee and Boulder dams. In April 1936 he became connected with the Tennessee Valley Authority as construction engineer on the Chickamauga Dam. He then served in a similar capacity on the construction of Kentucky Dam, the site of the work described in his prize-winning paper. Later he was transferred to the Upper Holston projects as project manager.

When work on these projects was suspended by the War Production Board in 1943, Mr. Hays became chief engineer for the Commission of Palestine Surveys, of New York. In this capacity he has been investigating the possibilities of irrigation and hydroelectric power development in Palestine.

Mr. Hays has written extensively on foundation problems of the TVA, and on grouting problems and construction methods encountered in his other work. Joining the Society as a Junior in 1913, he became an Associate Member in 1919 and Member in 1930. He was winner of the Collingwood Prize for Juniors in 1918.

LEWIS A. SCHMIDT, JR.

THIS YEAR'S WINNER of the James Laurie Prize is Lewis A. Schmidt, Jr., civil engineer of Chattanooga, Tenn. Mr. Schmidt was graduated from the University of Wisconsin in 1923, with the degree of B.S. in civil engineering. Ten years later he received the degree of M.S. in civil engineering from the University of Texas, and he received a C.E. degree from the University of Wisconsin in 1939.

Mr. Schmidt's early experience included more than six years with L. F. Harza, M. ASCE, Chicago consultant, on the design and construction of hydroelectric and water supply projects; a year as hydroelectric engineer for the Michigan Public Service Co., in charge of the rehabilitation of three hydroelectric projects; and a year and a half as engineer and assistant manager for the Central Texas Hydroelectric Co., at Austin, Tex.

From 1932 to 1934 Mr. Schmidt was at the University of Texas and with the parks division of the Texas FERA, and from 1934 to 1936 he was resident engineer inspector for the PWA on the construction of Red Bluff Dam, a Texas power and irrigation project on the Pecos River. During the latter period he was also engaged on water-works and sewerage projects for various Texas municipalities.

In 1936 Mr. Schmidt joined the staff of the Tennessee Valley Authority in the capacity of construction plant designing engineer, and from 1941 to 1944 he was in charge of the construction of the Hales Bar Dam project for the TVA. Since 1944 he has had a private practice in Chattanooga, where he specializes in foundations, heavy construction, and municipal work.

An Associate Member of the Society since 1930 and Member since 1942, Mr. Schmidt has been active in the Tennessee Valley Section. He has been secretary-treasurer and vice-president, and is currently serving as president. In 1946 he also was on the Section's Local Membership Committee.

Mr. Schmidt has published several papers on foundation and construction problems, and holds a patent assigned to the TVA on a substratum water-control method, which was devised for the work at Hales Bar Dam.

JAMES HOBSON STRATTON

JAMES HOBSON STRATTON, recipient of the Arthur M. Wellington Prize, has spent his career in the Army. Since May 1946 he has been supervising engineer for the Panama Canal, with the rank of colonel.

Born at Stonington, Conn., he served as a private and corporal in the New Jersey National Guard, and as a member of the Guard was in Federal service from April 1917 to May 1918. He was then appointed to the U.S. Military Academy at West Point. Upon his graduation in June 1920, with the B.S. degree, he was commissioned a second lieutenant of Field Artillery. In September 1920 he transferred to the Corps of Engineers, where he has been promoted through the various grades, attaining the temporary rank of brigadier general on May 28, 1944.

His first commissioned assignments were to Camp Humphreys, Va., and Camp Meade, Md., and in June 1921 he became a student officer at Rensselaer Polytechnic Institute. Two years later he received the degree of C.E. from that school. In October 1924 he was ordered to the Panama Canal Zone for duty with the 11th Engineers at Corozal, and later was regimental supply officer and personnel adjutant. Returning to the United States in 1927, he served tours of duty at Englewood, N.J., and Fort McIntosh, Tex., and from October 1933 to August 1935 was military assistant to the District Engineer at St. Paul, Minn.

Colonel Stratton then went to Tucumcari, N.Mex., as chief of the engineering division, Tucumcari Engineer District. He subsequently became engineering chief of the Conchas (N.Mex.) Engineer District, and in May 1937 was transferred to Boston as chief of the engineering division of the U.S. Engineer Office. After other assignments at Denison, Tex., and Caddoa, Colo., he was ordered to Washington, D.C., in December 1941 as chief of the engineering branch, Construction Division, Office of the Chief of Engineers.

In November 1943 Colonel Stratton was named Chief of Operations, Headquarters, Services of Supply, in the European Theater of Operations. Shortly thereafter he was redesignated as Assistant Chief of Staff, G-4 Headquarters, ETO, continuing in that capacity until March 1945 when he was ordered back to the United States. Upon his return, he was assigned to the Office of the Chief of Engineers in Washington, as assistant to the Chief of Engineers for Engineering, and in December 1945 was appointed Director of Civil Works, Office of the Chief of Engineers, in charge of all river and harbor and flood control work. He has been supervising engineer for the Canal Zone since May 1946.

Colonel Stratton was awarded the Legion of Merit in 1944 for his services as chief of the Engineering Branch (later the Engineering Division), Office of the Chief of Engineers, from December 29, 1941, to November 26, 1943. The citation stated, in part, that he ". . . displayed unusual foresight in the adaptation of the design of military construction in the United States to the conditions imposed by the reduced availability of materials, labor, and construction equipment."

Colonel Stratton became an Associate Member of the Society in 1937, and has been a Member since 1943.

C. O. CLARK

THE COLLINGWOOD PRIZE for Juniors goes to C. O. Clark, a specialist in the field of river hydraulics. Born in Lodi, Wis., Mr. Clark worked his way through the University of Wisconsin. Following his graduation in 1934, with the degree of B.S. in civil engineering, Mr. Clark was employed on public utility evaluation for the Public Service Commission of Wisconsin. There followed a brief engagement with the Tennessee Valley Authority, and two years of dam design and model testing for the Works Progress Administration.

Since the great Ohio River Floods of 1937, Mr. Clark has been with the Corps of Engineers on the hydraulics of river development for flood control and hydroelectric power. He has been located in the district offices at Louisville, Norfolk, and Washington, D.C. At present he is in charge of the hydraulic section of the U.S. Engineer Office at Norfolk. In this capacity he is engaged in the hydroelectric, hydraulic design, and hydrologic problems involved in the construction of the recently authorized Buggs Island and Philpott dams in the Roanoke River basin of Virginia and North Carolina.

From 1939 to 1943, Mr. Clark was faculty chairman of the engineering extension of the University of Virginia in Norfolk. He is a member of the American Geophysical Union, and member and vice-president of the Engineers' Club of Hampton Roads.

A member and president of the University of Wisconsin Student Chapter during his undergraduate days, Mr. Clark has been a Junior in the Society since his graduation.

JOHN S. McNOWN

WELL KNOWN IN the field of hydraulics is John S. McNown, winner of the J. C. Stevens Award. A native of Kansas, Mr. McNown was graduated from the University of Kansas in 1936, with a B.S. degree in civil engineering. He was a member of Tau Beta Pi, and at the time of his graduation received the Kansas Section award of Junior membership in the

Society. Following his graduation, he worked as part-time research assistant at the Iowa Institute of Hydraulic Research, University of Iowa, completing the work for a M.S. degree in hydraulics in 1937.

Mr. McNown then went to the University of Minnesota, where he served as instructor in the department of mathematics and mechanics until 1942. During this period he continued his graduate work, and in 1942 received a Ph.D. degree in hydraulics. As research associate in the Division of War Research of the University of California, he spent the next year on oceanographic problems related to the detection of submarines by sonic methods. This project, under the sponsorship of the National Defense Research Committee, led to investigations of the effects of turbulence in the wakes of ships and elsewhere in the ocean upon sound transmission.

In 1943 Mr. McNown returned to the University of Iowa as research engineer in the Institute of Hydraulic Research and assistant professor of mechanics and hydraulics. His principal research project has been a study of cavitation and pressure distribution around bodies of revolution—sponsored by the N.D.R.C. during the war, and the Taylor Model Basin of the Navy since the war. Representative results of the study were presented at the Third Hydraulics Conference in June 1946, in a paper entitled "Pressure Distribution and Cavitation on Submerged Boundaries."

Mr. McNown is a member of Sigma Xi, the American Society for Engineering Education, and the Iowa Engineering Society. An Associate Member of the ASCE since 1945, he has contributed a number of discussions to PROCEEDINGS. At present he is making a study of the "Hydraulics of Manifolds"—a project, sponsored by the Hydraulic Research Committee of the Society, which he is supervising at the University of Iowa.

GEORGE K. LEONARD

THIS YEAR'S RECIPIENT of the Construction Engineering Prize is George K. Leonard, who has been prominently identified with the TVA since its inception. Mr. Leonard was educated at the University of Nebraska, graduating in 1912 with the degree of B.S. in C.E. In 1937 he received the degree of C.E. from the same institution.

Following his graduation, he spent two years as bridge designer and inspector in the Nebraska Department of Public Works and a similar period as superintendent of a small foundry and structural steel shop. In 1917 he returned to the Department of Public Works as office engineer in charge of bridge and highway design, and later was promoted to the position of assistant state engineer.

Resigning from the department in 1921, Mr. Leonard became contracting engineer for Woods Brothers Construction Co., and in 1925 was made general superintendent in charge of the construction of the Starved Rock Lock and Dam on the Illinois River at Ottawa, Ill. Upon completion of this contract, he was placed in charge of all general construction.

During the next few years, Mr. Leonard supervised the construction of a number of large bridges and viaducts. An interesting and difficult job during this period was the construction of foundations for a mile-long transmission line, crossing the Mississippi below Memphis, for the Electric Bond and Share Co. This project required the sinking of four open concrete caissons 120 ft deep for supporting the 400-ft steel towers.

In 1933, shortly after the passage of the TVA Act, Mr. Leonard accepted the position of assistant construction engineer for the TVA on Wheeler Dam. He was appointed construction engineer on Guntersville Dam in 1937, and later served in a similar capacity on the construction of Watts Bar and Cherokee dams.

In July 1941 Congress authorized construction of the Hiwassee Projects for the purpose of generating additional power for national defense. Under the supervision of Mr. Leonard as project manager, the Apalachia, Ocoee No. 3, Nottely, and Chatuge dams were constructed and placed in operation in slightly over two years. The Apalachia Project included construction of an eight-mile tunnel, which was excavated in eleven months. Mr. Leonard described the lining of this tunnel in his prize-winning paper.

Upon the completion of the special work, Mr. Leonard served as head of the TVA Project Planning Division until July 1946. Since the latter date he has been project manager in charge of the construction of the Watauga and South Holston dams, which are being built for flood control and power generation on the upper tributaries of the Tennessee River.

Mr. Leonard has been a Member of the Society since 1936.

Society Gains Four New Honorary Members

A. W. K. BILLINGS

A. W. K. BILLINGS, who recently retired as president of the Brazilian Traction, Light & Power Co., first went to Brazil for that organization in 1922. In recognition of his work in developing the hydroelectric resources in the São Paulo-Rio de Janeiro area, the Brazilian government recently awarded him the National Order of the Southern Cross, its highest nonmilitary decoration.

Born in Omaha, Nebr., Mr. Billings received his higher education at Harvard University. He was graduated in 1895, with the degree of A.B., summa cum laude, receiving honors in physics, mathematics, and engineering. He was awarded the degree of A.M. in 1896, and spent the following year as assistant in physics and engineering mechanics.

A. W. K. BILLINGS
New Honorary Member

Later Mr. Billings received the honorary degree of electrical engineer from Tufts College.

His first work was on the construction of electric street railways and steam-electric power plants in Pittsburgh. Then, in 1899, he went to Cuba as engineer in charge of similar work for the Havana Electric Railway Co. From 1902 to 1906, he was chief engineer for the Havana Central Railroad Co. on heavy electric railroad construction in and near Havana, and from 1906 to 1909 he maintained a consulting practice in that city.

Returning to the United States in 1909, Mr. Billings spent the next two years as engineering manager for J. G. White & Co., a New York firm of engineers and contractors. From 1912 to 1916 he was in Barcelona, Spain—successively, as manager of construction, vice-president,

and managing director of the Barcelona Traction, Light & Power Co., Ltd. During this period he was engaged in building important hydroelectric plants and a concrete dam (Talarn), at that time the largest and highest in Europe.

In 1917 and 1918, Mr. Billings was in the Navy—first as works superintendent at the New York Navy Yard in charge of mechanical and electrical work, and later as officer in charge of the construction of naval aviation stations in Europe, with the rank of commander. For his services he received the U.S. Distinguished Service Cross and the French Legion of Honor.

At the end of the war he returned to Barcelona as consulting engineer for the Barcelona Traction, Light & Power Co., on the design and construction of hydroelectric plants and Camarasa Dam. From 1921 to 1924, Mr. Billings served as construction manager for the same company, the Mexican Light & Power Co., and the Brazilian Traction, Light & Power Co., on the planning and building of hydroelectric plants near Mexico City and Rio de Janeiro.

For the next 20 years he was vice-president of the Brazilian Traction, Light & Power Co., and of its several subsidiaries in Brazil, and during the past two years he has served as president of the company. However, he is now retiring from all these positions.

Notable among Mr. Billings' achievements in Brazil was the damming up and reversing the flow of streams in the São Paulo area to take advantage of a 2,000-ft drop from the mountainous plateau to the coastal plain. In addition to providing cheap power, which has had a profound effect on industrialization of the area, the project has been valuable for flood control. Mr. Billings has also been responsible for the design and construction of large hydroelectric installations for the Brazilian Hydroelectric Co., the São Paulo Tramway, Light & Power Co., the São Paulo Electric Co., and the Rio de Janeiro Tramway, Light & Power Co.

Mr. Billings became an Associate Member of the Society in 1906, and he has been a Member since 1908. He is also a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the Institution of Civil Engineers of London, and many other technical societies.

CHARLES B. BURDICK

CHARLES B. BURDICK has devoted his entire engineering career of 51 years to the service of cities and corporations, in matters of water supply, flood relief, and sewerage. Long a member of the Chicago firm of Alvord, Burdick & Howson, Mr. Burdick has done work for several hundred cities in 38 states and for several foreign countries.

Born in Chicago, Mr. Burdick was graduated from the University of Illinois in 1895. He was one of the first graduates in the newly established course of municipal and sanitary engineering. Immediately following graduation, he entered the office of the late John W. Alvord, Hon. M. ASCE, where for two years he was draftsman and assistant engineer. For the next five years he was in the employ of John A. Cole, under whom he planned and supervised improvements to numerous water-works systems. During this engagement he became familiar with the business side of water supply. He also assisted in the first experiments on the pitometer, now widely used for measuring flow in pipes.

CHARLES B. BURDICK
New Honorary Member

In 1902 he renewed his association with Mr. Alvord, returning as a partner, and for the next 21 years the firm carried on with increasing responsibilities. In 1923 the firm became Alvord, Burdick & Howson, under which name a large part of its work has been done.

A pioneer in water treatment by mechanical filter, Mr. Burdick was one of the first engineers to design large reinforced-concrete filters, and in recent installations has been responsible for $6^1/_4$-mgd filter units, the largest so far built. With others, he is now engaged as consulting engineer on additional filtration for the City of Chicago, involving a capacity of 950 mgd.

Recently completed work includes the 200-mgd plant at Milwaukee, an 84-mgd plant at Louisville, a 56-mgd plant at Denver, and more than 60 other plants. The treatment plant for Miami, Fla., is one of his larger ground-water softening plants. The firm has also been extensively engaged in sewage treatment, and has designed plants for a variety of conditions. It has been retained by the War Department to study the Chicago sewage-treatment problem in connection with the water diversion at that city.

Mr. Burdick has been connected with the development of water supplies from a wide variety of sources, including ground-water supplies, impounded supplies, and the special problems connected with supplies from the Great Lakes. He was engaged on the original layout of the Mokelumne River supply for the nine cities on the east side of San Francisco Bay, later carried out by the East Bay Utility District. In this project water was impounded and carried across the San Joaquin Valley. He also made extensive investigations and reports on a new water supply for Salt Lake City. His firm is now engaged in building an 80-mile pipe line to supply the cities of Saginaw and Midland, Mich., with water from Lake Huron.

Another important aspect of the firm's work has been the planning of continuing construction programs for several cities. Such programs have been followed for nearly 40 years at Des Moines, Iowa, and for 25 years at Louisville, Ky., and Racine, Wis., with all important construction carried out by Alvord, Burdick & Howson, as needed.

During the first World War, Mr. Burdick represented his firm as engineer in charge of engineering operations for the Constructing Quartermaster at Camp Las Cas in Puerto Rico, and of water, sewers, and roads at Camp Grant in Illinois. During the recent war he was in charge of similar work on the construction of cantonments in the Middle West.

Mr. Burdick has also given considerable time to flood relief. He prepared reports on the Illinois River for the State of Illinois, on the Scioto River for the Franklin County (Ohio) Conservancy District, and for numerous other states and municipalities.

Becoming an Associate Member of the Society in 1905 and a Member in 1911, Mr. Burdick served as Director from 1935 to 1937 and as Vice-President in 1941 and 1942. He has been a member of several Society committees, serving as chairman of the Committee on Publications and, more recently, as chairman of the Special Committee on Flood Relief. He is an honorary member of the American Water Works Association; honorary member and past-president of the Western Society of Engineers; and past-president of the Chicago Engineers' Club. He also belongs to the University Club of Chicago and several of the state engineering societies.

ALBERT P. GREENSFELDER

FOR MANY YEARS head of the Fruin-Colnon Contracting Co. in St. Louis, Albert P. Greensfelder is eminent in both the engineering and contracting

fields. A native of St. Louis, Mr. Greensfelder has been in charge of the construction of many of the city's important projects.

He was graduated from Washington University in 1901, with the degree of B.S. in civil engineering. Entering railroad work upon his graduation, Mr. Greensfelder was engineer on the construction of the Interurban Railway at

A. P. GREENSFELDER
New Honorary Member

Iola, Kans., for a year. He then became principal assistant engineer for the Terminal Association of St. Louis on the design and construction of railroad terminal facilities in the area, remaining in that position until 1906.

In the latter year he became connected with the Fruin-Colnon Contracting Co., as general superintendent of construction. He became secretary in 1908, and was president from 1927 to 1940. Mr. Greensfelder has been chairman of the company since the latter date. Important projects on which he has been engaged include the St. Louis water basins, intake tower, and tunnel; three reinforced concrete viaducts for the city; the St. Louis railway terminal; and \$10,000,000 of industrial plants in the St. Louis area. Mr. Greensfelder was chairman of the Fruco Construction Co. in 1941 and 1942, as co-venturer on the construction of the St. Louis Ordnance Plant, the largest small-arms ammunition plant in the world.

He has many professional affiliations. From 1932 to 1945 he was chairman of the Consulting Constructors Council of America. He has been president of the Associated General Contractors of America; president of the American Society of Engineering Contractors; president of the Associated Engineering Societies of St. Louis; president of the St. Louis Engineers' Club; and chairman of the Construction League of the United States. In 1943 he was the recipient of the Illinois Society of Engineers' annual award.

Long interested in civic affairs, Mr. Greensfelder served 25 years as chairman of the University City Plan Commission and has served as vice-chairman of the St. Louis County Planning Commission, the St. Louis Regional Planning Commission, the Missouri Planning Board, and the Missouri Conservation Commission. He was vice-chairman of the St. Louis Committee on Economic Development in 1944, and director of the St. Louis Metropolitan Plan Association in 1945. At present he is chairman of the Civic Development Committee and director of the St. Louis Chamber of Commerce. Mr. Greensfelder served as a director of the U.S. Chamber of Commerce from 1933 to 1939 and is a member of the Business Advisory Council for the Department of Commerce. He has been a delegate to several international congresses.

Mr. Greensfelder is the author of numerous articles on construction economics, which have appeared in the publications of the Society and other technical periodicals. His interest in engineering writing led him, in 1939, to establish the Construction Engineering Prize, which is given annually for the best construction paper appearing in Civil Engineering.

Mr. Greensfelder became a Junior in the Society in 1904, Associate Member in 1906, and Member in 1926. His services to the Society have included the chairmanship of the executive committee of the Construction Division.

LeROY K. SHERMAN

An expert in hydraulics and hydrology, Le Roy K. Sherman, Chicago consultant, feels that he has made his most important contributions to the engineering profession since the age of 60. Mr. Sherman is best known to the profession as the originator of the unit hydrograph. This new principle in hydrology was presented in 1932, and since that date it has been the basis for the design of important dams. A verification of the principles of the unit hydrograph was published in the March 1940 issue of Civil Engineering, under the title, "The Hydraulics of Surface Runoff." The Society Transactions contains valuable contributions on related applications and improvements.

From October 1933 to June 1935, he was a member of the Technical Board of Review of the Public Works Authority, Washington, D.C., which reviewed and made recommendations on the applications for Federal loans from states and municipalities. He was also (1934 to 1943) consultant, on the Basin of the Great Lakes, to the Water Resources Committee of the National Resources Planning Board. This work included an inventory of navigation, water supply, water power, and all the physical and hydrological elements affecting the stage, flow, and supply of water in the Basin.

During this same period, Mr. Sherman served as consultant to the National Parks Service on the elimination of stream pollution in Rock Creek Park, District of Columbia; and to the Hydro-

Le ROY K. SHERMAN
New Honorary Member

logic Division, Office of the Chief of Engineers, on the determination of the maximum required spillway capacity for Denison Dam on the Red River. And for four years (1938 to 1942) he was consultant to the Flood Control Division of the Soil Conservation Service on quantitative hydrologic procedure. Since 1938 he has also been consultant on hydrology and flood control to the U.S. Department of Agriculture.

Although born and educated in the East, Mr. Sherman has spent much of his career in Chicago. Following his graduation from the Massachusetts Institute of Technology in 1892, he entered railroad work. From 1895 to 1900 he was assistant engineer on the construction of the Chicago Drainage Canal, and from 1905 to 1912 resident engineer for the Sanitary District of Chicago on various construction projects. For the next five years Mr. Sherman was president of the Chicago contracting firm, L. K. Sherman Co., Inc. During this period he was also a member of the Illinois Rivers and Lakes Commission, engaged on the supervision of stream pollution and plans for flood control.

From March 1918 to July 1920 he was connected with the U.S. Housing Corp., in Washington, D.C.—for part of this period as president and director of the Bureau of Housing and Industrial Transportation. From 1921 to 1934 Mr. Sherman was president of the Randolph-

Perkins Co. During this period he prepared reports on the hydrology of the Illinois River, on lake levels and Chicago diversion, and many other hydrologic and water supply subjects. Since 1934 he has maintained a private practice, acting as consultant to numerous government agencies and other organizations.

A Member of the Society since 1910, Mr. Sherman served as chairman of the Water Policy Committee from 1938 to 1940. He has written on hydrologic subjects for Society and other technical publications, and is author of a manual on "Reduction of Runoff and Floods Through Agricultural Operations."

Mr. Sherman has been president of the American Association of Engineers and of the Illinois Society of Engineers, and is a member of the Western Society of Engineers and the National Drainage Congress. Joining the Section of Hydrology of the American Geophysical Union at its inception in 1932, Mr. Sherman served as president of the section from 1936 to 1939. He has also been chairman of the Committee on Rainfall and Runoff of the American Geophysical Union.

ASCE Labor Policy to Be Basis of EJC Panel Presentation to Congress

REPRESENTING SOME 100,000 Engineers, an Engineers Joint Council panel will present a united front for the engineering profession before the 80th Congress in seeking labor legislation changes based on the policy which was adopted by the American Society of Civil Engineers in October.

This was decided at a meeting in ASCE headquarters last month, when Engineers Joint Council adopted the ASCE labor policy as representing "the consensus of the membership of the five constituent societies of Engineers Joint Council," and recommended that the presidents of the constituent societies each appoint one of their members to such a panel. In addition to the five constituent societies, the American Society for Engineering Education and the National Society of Professional Engineers also have been invited to appoint one representative each to the panel.

E. L. Chandler, Eastern Representative of ASCE, with offices in Washington, D.C., is to arrange for the time that the panel will make its presentation of facts regarding labor legislation as it affects professional men. Mr. Chandler made a presentation on behalf of the ASCE last July 10 before the subcommittee of the House Labor Committee (see CIVIL ENGINEERING for August 1946, page 339). That presentation stressed the inherent differences between the viewpoints and attitudes of professional men and those of non-professionals; recognized the principle of collective bargaining; but asked freedom for professional men to form bargaining units composed exclusively of professional men, and only when and as they chose to do so, and enunciated certain principles which should be embodied in changes in the Wagner Act, which were strongly advocated.

The ASCE labor policy, adopted by the Board of Direction at its Fall Meeting in Kansas City (see CIVIL ENGINEERING for November 1946, page 511), on recommendation of the Committee on Employment Conditions, incorporates the same principles. At the time the Board of Direction adopted the statement of policy for ASCE, it adopted a companion policy for EJC and recommended it to the joint council.

Another Engineers Joint Council action in which ASCE men played prominent roles was the reconstitution of the National Engineers Committee on Technological Disarmament. The Engineers Joint Council dissolved the Executive Committee, under direction of which the reports on disarmament of Germany and Japan were prepared for the War, Navy and State Departments, and expressed gratitude for these major contributions made on behalf of, and which obtained widespread recognition for, the entire engineering profession. The reconstituted Committee on Technological Disarmament, it was decided by Engineers Joint Council, is to be available for cooperation with the atomic energy commission or any other use the government desires to make of it. Appointed to the committee are three New York ASCE men: Col. Carlton S. Proctor, Malcolm Pirnie, Past-President, ASCE, and Dr. Harry S. Rogers. The fourth member is Sidney Kirkpatrick. Chairman Proctor is authorized by Engineers Joint Council to appoint additional members for the duration of any specific task.

New York Sections Form Joint Committee

IN ACCORDANCE WITH the recommendation adopted at their meeting on June 22 (see CIVIL ENGINEERING for September 1946, page 408), the six Local Sections in New York State have formed a Joint Committee whose function is to present to the legislature at Albany the recommendations of the ASCE membership in the state relative to proposed or desired legislation. The committee membership is as follows:

SECTION	REPRESENTATIVE
Buffalo	Lt. Col. Harland C. Woods
Ithaca	Prof. Frederick J. Spry
Metropolitan	Dr. D. B. Steinman
Mohawk-Hudson	Robert C. Wheeler
Rochester	Col. Carey H. Brown
Syracuse	Earl F. O'Brien (provisional chairman)

At present the committee is considering two amendments to the education law: one to permit action by injunction to prevent improper use of the term "engineer" by unlicensed individuals, and the second to authorize appointment of a full-time secretary to the Licensing Board who would not be a member of the board.

It is the committee's intention to work in close harmony with the New York State Society of Professional Engineers so as to present a united front at Albany.

Washington U. Chapter Has 40th Anniversary

ONE OF THE OLDEST Student Chapters—that at Washington University, St. Louis—celebrated its fortieth anniversary in 1946. In honor of the occasion, the Chapter recently held a banquet attended by the faculty, students, and alumni of the Washington University civil engineering department.

Special guest of honor was Society President W. W. Horner, who extended his congratulations in an informal after-dinner talk. The other speakers were Dr. Victor Hamburger, professor of zoology at Washington University, and E. O. Sweetser, professor of civil engineering. Professor Sweetser, who is Faculty Adviser for the Chapter, outlined the history and early activities of the organization.

The Student Chapter grew out of the Washington University Collimation Club, which was organized in 1906 and converted into a Student Chapter in 1920. Since its formation forty years ago, the organization can boast of continuous activity.

Detroit Engineers to Get Refresher Courses

AN OPPORTUNITY TO reinforce and refresh previous educational backgrounds is being offered, by the Engineering Societies of Detroit, to engineers desiring to take the state examination for registration as professional engineers or architects. Attendance will be limited to members of the Engineering Societies of Detroit and its affiliate organizations, which include the Michigan Section of

ASCE. Courses will be given on Saturdays, starting the first week in January and ending the last week in April.

The refresher course for engineers will be divided into Part I, covering engineering fundamentals; and Part II, covering engineering law, ethics, report writing, and general business practice.

A tuition fee of $25 for those taking the entire course, and of $15 for those taking only one part of the engineering work, has been set.

Those interested in taking the course should apply at the E.S.D. office, 100 Farnsworth Ave., Detroit, for registration blanks.

Two Southern Sections Have Three-Day Meetings

Highlighting their fall season activities, the Texas and Mid-South Sections held convention-scale, three-day meetings at which current issues of vital importance to the profession were discussed by nationally prominent speakers. At each of these meetings, Section officers for 1947 were elected and several technical papers of local interest were presented.

TEXAS MEETING—LAREDO, TEX. November 21, 22, and 23, 1946

ASCE Director O. H. Koch, of Dallas, Tex., and Executive Secretary William N. Carey, from Society Headquarters, addressed the Texas Section on current Society activities. At the business session of the meeting, C. M. Blucher, of Corpus Christi, was elected president of the Section for 1947 and John A. Focht, of Austin, was reappointed secretary-treasurer.

Following a precedent set 15 years ago, a joint full-day meeting was held November 23 with La Sociedad de Ingenieros y Tecnicas de Monterrey, in Monterrey, Mexico, which featured an interesting field inspection of a nearly completed cantilever plate-girder bridge.

Inspection of Monterrey's principal brewery—at which the Texas contingent of nearly 100 were served beer and lunch—plus an inspection of a tile and brick plant—at which an excellent luncheon was served—created considerable international good will. Those present agreed unanimously that similar meetings should be held frequently—annually, if possible.

J. Maiz Meir, president of the Monterrey Engineering Society, presided at a joint technical session of the two engineering groups. This session was followed by a steak dinner for the 200 members attending.

MID-SOUTH MEETING—MEMPHIS, TENN. December 5, 6, and 7, 1946

Principal speakers at the meeting of the Mid-South Section were Brig. Gen. Max C. Tyler of Vicksburg, who discussed "River and Railway Terminals," and Lt. Gen. R. A. Wheeler, U.S. Chief of Engineers, who described the work of the Corps of Engineers in peace and war. Society affairs were discussed by ASCE Director H. F. Thomson.

A report on collective bargaining by the chairman of the Section's Committee on Professional Objectives elicited brisk discussion from the floor. Society affairs were discussed by ASCE Director H. F. Thomson. The meeting adjourned with a note of thanks to Frank Ragsdale, general meeting chairman, and his committee for their successful planning of the three-day meeting.

Country Is Divided Into Three Sections for ASCE Representation

Division of the country into three sections, which will be under ASCE representatives charged with field secretarial duties, is announced by Col. William N. Carey, Executive Secretary.

The same announcement, effective as of November 16, 1946, also calls attention to the establishment of the office of the Mid-West Representative in Chicago, as directed by the Board of Direction, and to changes in the terminology of the present field offices in Washington and Los Angeles, which are to be known, respectively, as the "Office of the Eastern Representative" and the "Office of the Western Representative."

The Eastern Representative is charged with field secretarial duties for the Society in the following states: Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, Rhode Island, Pennsylvania, New Jersey, Delaware, Maryland, West Virginia, Virginia, North Carolina, South Carolina, Georgia, and Florida.

In the territory of the Mid-West Representative are Ohio, Kentucky, Tennessee, Alabama, Mississippi, Michigan, Indiana, Wisconsin, Illinois, Minnesota, Iowa, Missouri, Arkansas, Louisiana, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas.

The states to be covered by the Western Representative are Montana, Wyoming, Colorado, New Mexico, Idaho, Utah, Arizona, Washington, Oregon, Nevada, and California.

The names and addresses of the ASCE Representatives are:

E. L. Chandler
Eastern Representative, ASCE
1026 17th St., N.W., Room 703
Washington 6, D.C.

Walter E. Jessup
Western Representative, ASCE
400 Edison Bldg.
Los Angeles 13, Calif.

George S. Salter
Mid-West Representative, ASCE
53 West Jackson Blvd.
Chicago, Ill.

ASCE Vice-President J.T.L. McNew Is Dead

News of the death of ASCE Vice-President J. T. L. McNew—in Houston, Tex., on December 21—will come as a shock to his many friends who were informed in the December issue of Civil Engineering that he was recovering from a cerebral hemorrhage suffered a few weeks earlier.

J.T.L. McNew
(1895–1946)

Although death came to Colonel McNew at the early age of 51, he leaves behind him a brilliant record of achievement in engineering. His work in engineering education well qualified him for the position he held at the time of his death, that of vice-president of engineering at Texas A. & M. College. He served the Society well, energetically heading many of its committees. As Director (1942–1945) on the Society's Board of Direction, and later as Vice-President, he helped determine ASCE policies, contributing his sound judgment to the many important decisions the Board has made in recent years. His term as Vice-President would have expired in January 1948.

An alumnus of Texas A. & M. College, Colonel McNew had been on the engineering staff there since 1920, having served in positions from instructor to professor of highway engineering. From 1940 to 1945 he was head of the department of civil engineering, and since his return from service in the Army in early 1945, he has served as vice-president for engineering.

Colonel McNew was a veteran of both World Wars. During the recent war he was a lieutenant colonel on the staff of the Air Engineer in the China-Burma-India Theater, which was concerned with ground installations for combat and cargo aircraft.

News of Local Sections

Coming Events

CENTRAL OHIO—Dinner meeting at the Chittenden Hotel, Columbus, January 23, at 6 p.m.

DISTRICT OF COLUMBIA—Annual dinner meeting at Hotel 2400, Washington, D.C., January 28.

INDIANA—Joint meeting with the Indiana Society of Professional Engineers at the Hotel Lincoln, Indianapolis, January 22, at 6:30 p.m.

METROPOLITAN—Meeting in the Engineering Societies Building, New York, January 8, at 8 p.m.

NORTH CAROLINA—Annual meeting at the Carolina Hotel, Raleigh, January 10, at 10 a.m.

NORTHEASTERN—Dinner meeting at the Engineers' Club, Boston, January 20, at 6 p.m. Speakers will be incoming President E. M. Hastings and Executive Secretary Carey. The annual business meeting will be held at 4 p.m.

PHILADELPHIA—Meeting at the Engineers' Club, January 14, at 7:30 p.m.; dinner at 6 p.m. There will be a symposium on public works, with members of the Public Works Association invited.

SACRAMENTO—Regular luncheon meetings at the Elks Club, Sacramento, every Tuesday at 12 noon.

SOUTH CAROLINA—Annual winter meeting at the Columbia Hotel, Columbia, January 31, at 10 a.m.

TEXAS—Luncheon meeting of the Fort Worth Branch at the Blackstone Hotel, Fort Worth, January 13, at 12.15 p.m. Luncheon meeting of the Dallas Branch at the Adolphus Hotel, Dallas, February 3, at 12:15 p.m.

TRI-CITY—Joint meeting with the Tri-City chapter of the American Society for Metals at the Rock Island Arsenal Cafeteria, Rock Island, Ill., January 7, at 6:30 p.m.

WISCONSIN—Meeting in the ESM Building, Milwaukee, January 23, at 7:30 p.m.

Recent Activities

ARIZONA

SPEAKING BEFORE THE annual fall meeting of the Section—held in Phoenix on November 30—Walter Jessup, Western Representative ASCE, commented that the Society has passed the crossroads of whether it will be a mere honor society or a society of service and usefulness to its members. In deciding to take the latter road, he said, the Society is encountering economic problems resulting from increased costs, and predicted that the Sections will soon be canvassed for their opinion on the proposed increase in dues. Other speakers appearing on the all-day program were H. L. Royden, president of the Arizona chapter of the Associated General Contractors, who discussed the relationship between engineers and contractors; W. W. Lane, general manager and chief engineer of the Maricopa Reservoir and Power Co., who reviewed the water problems of the state; Perley Lewis, former lieutenant colonel in the Army Corps of Engineers, who described the construction of the Ledo Road in Burma; and C. R. Mocine, planning director for the city of Phoenix, whose subject was "Zoning as an Instrument of Planning." During the business session, the following officers were elected for the coming year: Walter Johannessen, president; John A. Baumgartner, vice-president; and Leigh O. Gardner, secretary-treasurer.

BUFFALO

SPEAKERS AT TWO recent luncheon meetings have been Bertram D. Tallamy, deputy superintendent of public works of the State of New York, and Paul E. Mohn, dean of the new school of engineering at the University of Buffalo. The latter discussed the development of the school, while Mr. Tallamy described the Department's plans for the Niagara throughway and arterial route development, dwelling particularly on survey methods used to determine the relative volume and flow of traffic. At one of the meetings a certificate of life membership was presented to William T. Huber.

CENTRAL ILLINOIS

THE ANNUAL ELECTION of Section officers, which was held at the December meeting, resulted as follows: L. E. Philbrook, president; W. M. Lansford, first vice-president; N. H. Gundrum, second vice-president; and Ellis Danner, secretary-treasurer. Guest of honor and principal speaker at the November dinner meeting was Dr. Harold Vonachen, medical director of the Caterpillar Tractor Co., who discussed the subject, "Human Engineering."

CENTRAL OHIO

EXPANSION OF SOCIETY operations in the past quarter of a century was discussed by James E. Jagger, Assistant Secretary ASCE, at the annual meeting on December 12. From an association made up primarily of mature engineers, whose chief concern was technological improvement, the Society has come a long way, Mr. Jagger said. Now there are 7,000 Juniors, constituting one-third of the membership of the Society, and interest in the student begins when he enters the technical school, or even before. Mr. Jagger also cited the growth of Society interest in the economic welfare of its members and in efforts to elevate the profession. An enthusiastic general discussion followed his talk. The new Section officers are: George E. Large, president; Carl C. Walker, first vice-president; Clarence D. Bowser, second vice-president; and Robert K. Morris, secretary-treasurer.

CINCINNATI

A TECHNICAL DESCRIPTION of the construction of three of the world's largest drydocks for the Navy Department was given by Daniel H. Young, director of Foley Brothers, Inc., at the December 4 meeting. Two of the drydocks are at Philadelphia, and the third at the Norfolk Navy Yard, Portsmouth, Va. Over a thousand feet long and 150 ft wide, they permit construction of the heaviest battleships. Intricate and novel engineering problems solved during construction included the pouring of concrete foundations 14 ft thick at under-water depths of 40 ft or more. The meeting was a joint session with local groups of the American Society of Mechanical Engineers and the Society of American Military Engineers and the Engineering Society of Cincinnati. At the November meeting Sherman L. Reeder, director of master planning for the Cincinnati Planning Commission, gave an illustrated talk on the various features of the plan.

COLORADO

MEMBERS ATTENDING THE October dinner meeting heard Dr. C. E. Dobbin, regional geologist for the Conservation Branch of the U.S. Geological Survey, discuss the geology of the Rocky Mountain region. Dr. Dobbin placed particular emphasis on the relationship of the material in the folded ranges of the Rockies to that of raised plain areas, such as the Grand Canyon and the mesas of Wyoming, Colorado, and Arizona.

DISTRICT OF COLUMBIA

BOTH ASCE Vice-President Gail Hathaway and Director Roy W. Crum attended the annual business meeting, which was held in Washington on November 19. Mr. Crum discussed matters being considered by the Board of Direction—among them the question of an increase in Society dues and the possibility of simplifying the application procedure. During the evening Mr. Hathaway presented certificates of life membership to the following members of the Section: C. D. Avery, G. R. Boyd, R. D. Bradbury, J. S. Bright, G. B. Canaga, H. R. Hall, J. E. A. Linders, C. W. Stark, and J. H. Stone. Three other members similarly honored—C. A. Hoglund, L. A. Jones, and C. H. Pierce—were absent. A motion to en-

dorse the collective-bargaining policy, adopted by the Board of Direction at the Kansas City Meeting, was carried. Other Section business included the election of the following new officers: W. G. Hoyt, president; C. D. Curtiss, vice-president; C. J. Stevens, secretary; and A. L. Cochran, treasurer.

FLORIDA

Two meetings devoted to Society affairs were scheduled for November. At the first of these sessions, Harold A. Scott, president of the Section and Section delegate to the Kansas City Meeting, presented a detailed report on current Society affairs and policies. Mr. Scott also summarized recent EJC activities, which were discussed from the floor. Later in the month there was a special meeting to hear James E. Jagger, Assistant Secretary of the Society, discuss problems currently before the Board of Direction.

ILLINOIS

About 60 young engineers turned out for a dinner meeting and smoker on December 4—the first time the Juniors of the Section have met since the war caused temporary suspension of their activities. The group displayed lively interest in Society affairs, as discussed by George S. Salter, newly appointed Mid-West Representative ASCE, and A. L. Sanders, secretary of the Illinois Section. Card games concluded the evening enjoyably, and it was the consensus of opinion that this organization of young civil engineers in the Chicago area has a good postwar future.

INDIANA

Several committee reports were read at the annual meeting—held in Indianapolis on November 26—and new officers were elected. These are L. S. Finch, president; Carl E. Vogelgesang, vice-president; and B. A. Poole, secretary-treasurer. The technical program consisted of a talk by Tino Poggiani, former commanding officer of the 67th Naval Construction Battalion, who described the activities of the Seabees in connection with the Tinian campaign.

INTERMOUNTAIN

Irrigation and drainage practices in Utah were discussed at a recent meeting. The principal speaker was O. W. Israelsen, member of the engineering faculty at Utah State Agricultural College, who described the Utah Agricultural Experiment Station's cooperative irrigation and drainage research project. He was followed by three members of the college staff—J. Howard Maughn, Eldon G. Hanson, and Dean F. Peterson, Jr.—whose talks ranged from the economics of irrigation to research and investigation in the use of irrigation waters in Utah. At the November meeting, J. A. Hale, vice-president of the Utah Power and Light Co., talked on "Engineering Cooperation in the Industrial Development of Utah." Problems and progress in the allocation of Colorado River water to Utah and the Basin states were then described by E. H. Watson, state engineer of Utah.

IOWA

Two talks on Society affairs by ASCE President W. W. Horner highlighted the annual meeting, held at Des Moines on the afternoon and evening of November 21. A number of Student Chapter members were present, and talks by several of them were another feature of the program. During the afternoon business session, L. W. Mahone was elected president, and M. G. Spangler vice-president. L. O. Stewart was reelected secretary-treasurer. At the dinner meeting, Edward Bartow received a certificate of life membership. The technical program on a later occasion consisted of a talk by R. A. Moyer, research associate professor of civil engineering at Iowa State College, who discussed "The Engineer's Responsibility in the Present Iowa Highway Traffic Emergency."

ITHACA

The November meeting was a joint session with the Cornell University Student Chapter. An illustrated talk on providing Navy docking facilities during World War II comprised the technical program for the occasion. This was given by Capt. James T. Reside, of the Naval Reserve. The Section recently elected the following new officers for the coming year: L. L. Huttleston, president, and F. L. Bolton and E. W. Schoder, Vice-Presidents. Marvin Bogema will continue as secretary-treasurer.

KENTUCKY

Much of the first fall meeting of the Section—held at the University of Louisville recently—was devoted to business discussion. The group also discussed with C. R. Sansbury, secretary-treasurer of the Section and Section delegate to the Kansas City Meeting, some of the points to be discussed at Kansas City. An illustrated talk on the "Sewerage System of Louisville, and Sewer Rentals" was then given by Wallace W. Sanders, chief engineer of the Louisville Department of Public Works.

LEHIGH VALLEY

Addressing the annual meeting of the Section—held in Bethlehem, Pa., on December 10—Allen Wagner, public relations assistant to the Secretary, gave a résumé of Society affairs. In discussing the proposed increase in Society dues, Mr. Wagner stated that the Board desires an expression of opinion from every Local Section. The speaker also outlined the Society's year-old public relations program. During the evening the following new officers were elected: James W. Pastorius, president; Victor W. Anckaitis, first vice-president; and E. Leland Durkee, second vice-president. M. O. Fuller was reelected secretary-treasurer. There were 45 present. About 70 members of the Student Chapters at Lehigh University and Lafayette College were guests of the Section for the November meeting. Principal speaker on this occasion was Arthur P. Miller, sanitary engineer director for the U.S. Public Health Service, who addressed the gathering on "Public Health Service and Engineering." The list of guests included ASCE Director Howard T. Critchlow.

LOUISIANA

Numerous business matters were discussed at the November meeting, and it was decided that the Section would appoint a committee to investigate and study public works undertakings of major proportions, under consideration for construction within the area of the Section, and to submit recommendations on them to the Section. A talk by Elmer E. Shutts, consulting civil engineer of Lake Charles, La., comprised the technical program. Mr. Shutts' subject was "Development of the Port of Lake Charles."

METROPOLITAN

A six-lane, limited access, divided highway across New York State—with no traffic lights and a 70-mph speed limit—is included in the program of the State of New York, according to Charles H. Sells, superintendent of public works. Mr. Sells gave the first of two papers before a capacity gathering of 500 members and guests of the Metropolitan Section on November 20. The second paper—by Charles S. Noble, New Jersey state highway engineer—presented a thorough study of northern New Jersey's problem of providing adequate highways for the traffic between the two most heavily populated states, New York and Pennsylvania. Both speakers answered questions from the floor.

A contract is not just a piece of paper, but is the power or right to enforce a promise in a court of law as expressed by the apparent intention of language of the agreement, according to Oren C. Herwitz who spoke before 300 members of the Section on December 18. Mr. Herwitz—a practicing lawyer in New York City and formerly deputy commissioner and special counsel to the Department of Public Works, City of New York—explained some of the finer points of law covered by ASCE Manual No. 8.

"Getting out the Black Gold of Venezuela" was the subject of a Kodachrome-

illustrated talk heard by members of the Junior Branch on December 4. This was given by Edward J. Cleary, chairman of the Metropolitan Section's Committee on Juniors and executive editor of *Engineering News-Record.* One of the major oil-producing areas of the world, Venezuela is the scene of activity for many North American civil engineers. Mr. Cleary, who recently returned from a visit to Venezuela, called attention particularly to oil-field operations, where engineers are engaged in the design and construction of roads, special foundations for wells in deep water, housing, and sanitation facilities.

MID-MISSOURI

A MEETING OF the Mid-Missouri Section was held in Springfield, Mo., in conjunction with the state convention of the Missouri Society of Professional Engineers. A program covering a wide range of subjects had been scheduled, and the list of speakers included Robert P. Nichols, whose topic was "The Le Tourneau Story"; V. S. Peterson, who discussed the value of scientific research; Col. G. E. Galloway, who spoke on flood control of the White River Basin; J. H. DeLoria, who commented on the subject of public relations; and A. L. McCawley, an attorney, who discussed enforcement of the Missouri Registration Law for Engineers and Architects. During the business session, the procedure for bringing the younger members of the Section into closer contact with the older engineers was a principal topic of discussion. An attempt was also made to solve organizational problems experienced by the Student Chapters in the area. These problems are caused by the unprecedented enrollment of students and veterans. A luncheon at noon and a dinner dance in the evening added to the success of the all-day gathering.

MOHAWK-HUDSON

DIFFICULTIES ENCOUNTERED IN constructing a submerged weir at Niagara Falls were described by Louis S. Bernstein, chief designing engineer for the Buffalo-Niagara Electric Co., at the November meeting of the Section. The structure was erected in 1937 on the Canadian side of the river immediately upstream from the Horseshoe Falls. As the depth of the river at this point is 25 ft and the velocity about 20 ft per sec, the difficulty of the undertaking was great. A unique system of prefabricated steel cells, which were subsequently weighted with gravel and into which stop-logs were fitted, was employed to create a lee for the construction of the actual cofferdam within which the weir was built in the dry. Mr. Bernstein illustrated his talk with slides that eloquently described the dangerous conditions existing at the site. Despite these hazards, only one man was lost in the operation, Mr. Bernstein pointed out.

NASHVILLE

THE OFFICERS OF the Vanderbilt University Student Chapter were guests of the Section for the December dinner meeting. During the business session, D. C. A. du Plantier, Section delegate to the Kansas City Meeting, reported on the meeting, and the annual election of officers was held. These are D. C. A. du Plantier, president; Herman S. Schick, vice-president; and James F. Sharp, secretary-treasurer. The technical program consisted of a talk by E. E. Parks, manager of lighting sales for the Nashville Electric Service, who discussed the four general methods of heating homes electrically.

NORTH CAROLINA

SPEAKING AT THE fall meeting—an all-day session, held in Durham on November 8—ASCE Director William Piatt spoke on aims and objectives of the Society. Mr. Piatt addressed his talk particularly to the many Student Chapter members who were in attendance from Duke University and North Carolina State College. The Student Chapters were represented on the program with two papers by members of the Duke Chapter—E. L. Jones, Jr., and H. L. Becker. The list of distinguished guests included Malcolm Pirnie, Past-President of the Society, and ASCE Director R. W. Gamble. Both spoke on Society affairs, and Mr. Pirnie also discussed EJC in its relationship to the Foundation Societies. An open forum on the subject of EJC activities followed Mr. Pirnie's talk, and the Section went on record as favoring the aims of the organization. A timely talk on "Some Aspects of Present-Day Labor Legislation" was presented by Frank de Vyver, professor of economics at Duke University, at the noon dinner meeting. During the afternoon technical session, the group also heard T. F. Hickerson, professor of applied mathematics at the University of North Carolina, describe a new method of calculating areas.

OKLAHOMA

THE SECTION ELECTED new officers at its annual meeting that took place in Tulsa on November 29. These are Hubert L. Hendrix, president; Leo L. Laine, first vice-president; and J. Ray Matlock, second vice-president. J. E. Lothers will continue as secretary-treasurer. A symposium on the sewage-treatment plants and proposed improvements at Oklahoma City comprised the technical program, with Webster L. Benham, Oklahoma City consultant, presenting the principal paper. The paper was discussed by Allan Craig, Tulsa consultant, and E. R. Stapley, dean of engineering at Oklahoma Agricultural and Mechanical College.

OREGON

J. C. STEVENS, Past-President of the Society, attended the November meeting and spoke on EJC aims and activities, citing the history of ASCE participation in the group. Aside from such outstanding accomplishments as drawing up a plan for the industrial disarmament of the aggressor nations, Mr. Stevens pointed out, Council meetings have been instrumental in fostering good feeling among engineers. His talk was followed by an enthusiastic general discussion.

PANAMA

RECENT ACTIVITIES INCLUDE a field trip to the S.E.D. Hydraulic Laboratory at Miraflores, where the group had an opportunity to observe the operation of a 1:100-scale hydraulic model of a possible sea-level canal route. The various features of the laboratory were explained by Col. Ellsworth I. Davis, and Messrs. F. S. Brown, E. A. Schultz, and R. F. Kreiss. At the annual dinner meeting, which was held on December 2, new officers were elected for the coming year. These are James H. Stratton, president; Nelson E. Wise, first vice-president; Tomas Guardia, second vice-president; and Ernest W. Zelnick, secretary-treasurer. Guest of honor and principal speaker was S. E. Hulse, who discussed "Salient Features of the National Airport of Panama."

PHILADELPHIA

THE HISTORY AND activities of EJC were discussed by Executive Secretary William N. Carey at the November dinner meeting. Colonel Carey outlined the following five-point program being carried out by the Council: (1) to coordinate policies and activities of the various engineering societies; (2) to advance professional development; (3) to improve the economic status of the engineer; (4) to act on engineering matters of national importance (especially on legislation affecting engineers); and (5) to promote international engineering relations. As an example of what the Council is doing, Colonel Carey stated that 72 tons of technical literature has been sent to Europe under the auspices of EJC.

Members attending the December meeting—a joint session with the Philadelphia section of the A.S.M.E.—heard a symposium on atomic energy. The scheduled speakers appearing on this program were Dr. Edgar J. Murphy, assistant director of research at the Clinton Laboratories of the Monsanto Chemical Co., Oak Ridge, Tenn., and C. A. Powel, assistant to the vice-president in charge of engineering for the Westing-

house Electric Corp., Pittsburgh. Dr. Murphy stated that the discovery of atomic energy brings into sharp focus the necessity for a review of the adequacy of our educational system, particularly in so far as engineers and scientists are concerned. Mr. Powell discussed the subject from the engineer's point of view. The highlight of his talk was a summary showing that the use of atomic power is still in the distant future.

PITTSBURGH

THERE WAS A large turnout of Student Chapter members for the annual "Student Night" that took place on November 19. The program for this highly successful meeting, which was a joint session with the Engineers' Society of Western Pennsylvania, consisted of talks by members of the University of Pittsburgh and Carnegie Institute of Technology Chapters. The Section points out that its fall program has been considerably disrupted by the local power strike and a current hotel strike.

SACRAMENTO

A COMMITTEE REPORT to inform the Section on the origin, objectives, and activities of EJC constituted the program at the first November luncheon meeting. Following the reading of the report and a general discussion from the floor, the Section decided to go on record as favoring the continuation of EJC for the present. At another gathering, Milton Harris described his recent experiences in Italy with the American Military Government. Of special interest were his remarks on the rehabilitation of the transportation system in that country. Photogrammetry was the subject of the last meeting, when C. P. Van Camp, topographic engineer with the U.S. Geodetic Survey, described recent advances in the science of aerial mapping.

ST. LOUIS

PLANS FOR A series of reservoirs in the upper Missouri River valley were outlined by Brig. Gen. Lewis A. Pick, division engineer in the U.S. Engineer Office at Omaha, Nebr., at the December 5 meeting, which was a joint session with the Society of American Military Engineers. General Pick stressed the multiple uses to which these reservoirs will be put—flood control, irrigation, hydroelectric power, and maintenance of a 9-ft navigable channel on the Missouri River. He also explained that, although the storage reservoirs would inundate many acres of land, the program would restore an estimated 5,000,000 acres, which cannot be used for farming at the present time because of lack of irrigation. The program is ready, according to General Pick, and the start of construction awaits only the appropriation of necessary funds.

TRI-CITY

GUESTS OF HONOR and principal speakers at the annual meeting—held at Davenport, Iowa, on November 20—were President W. W. Horner and ASCE Director Wilbur M. Wilson. The latter described his experiences as Society representative at the Bikini atomic bomb tests, while President Horner addressed the Section on the subject of Society affairs. The main points of Mr. Horner's talk concerned the Society's financial status and the progress being made in EJC. The program for the day included a noon luncheon for Mr. Horner, which was attended by the Section officers, and an inspection trip to engineering projects in the tri-city area. In the annual election of officers, George M. Wood, of Rock Island, was chosen president, and Allen R. Boudinot, of Moline, vice-president. Albert F. Burleigh, of Rock Island, was reelected to the post of secretary-treasurer.

SEATED AT SPEAKERS' TABLE at annual luncheon meeting of Tri-City Section are, left to right, F. L. Fynt, associate engineer, U.S. Engineer Office at Rock Island; ASCE President W. W. Horner; H. S. Smith, president, Tri-City Section; W. M. Wilson, ASCE Director, District 8; and Col. W. N. Leaf, district engineer, U.S. Engineer Office, Rock Island.

TACOMA

WHETHER OR NOT professional engineers employed by government agencies should take outside or private engineering consulting work was debated at the November meeting. Participants in the discussion were J. P. Hart, E. C. Dohm, and E. L. Warner. The remainder of the evening was devoted to brief talks by George Andrew, of the Washington State Highway Department, who described the inspection of bridge structures, with observations on the disintegration of concrete in existing structures; and Walter Hoffman, of the U.S. Geodetic Survey, who discussed his work in the construction of gaging stations and cableways in the district.

TEXAS

THE GOVERNMENT'S long-range highway program calls for at least six interstate highways through Dallas, T. E. Huffman, engineer-manager of Dallas' express traffic ways for the State Highway Department, told members of the Dallas Branch. Speaking before the regular December luncheon meeting of the group, Mr. Huffman and his aids outlined the relationship of the superhighway system to the Dallas Master Plan.

The November luncheon meeting of the Fort Worth Branch was addressed by J. C. Burgess, local consultant, who spoke on the major airport development plan for Fort Worth. Mr. Burgess' talk was based on a report his firm prepared for the city of Fort Worth. A report on the Kansas City Meeting of the Society, given by Don Lee, concluded the program.

TOLEDO

ASCE DIRECTOR Frank C. Tolles attended the November meeting and spoke on Society affairs, commenting particularly on EJC and the current financial status of the Society. The rest of the session was given over to business discussion.

WEST VIRGINIA

ENGINEERING IN THE Navy was discussed by Capt. E. N. Blackwood, of the Navy Civil Engineer Corps, at a recent dinner meeting. Captain Blackwood outlined the history of the Corps, and then described specific problems and experiences encountered during his overseas tour of duty in World War II. Sound motion pictures—"Construction of an Advanced Base" and "Earth Movers"—supplemented Captain Blackwood's talk. Part of the meeting was devoted to a report of the special committee appointed to make a study of EJC. George W. Zimmer, Jr, chairman of the committee, summarized the origin, work, and objectives of the Council and cautioned against its being allowed to develop into another national engineering society.

WISCONSIN

THE TECHNICAL PROGRAM for the November dinner meeting consisted of a talk by L. J. Markwardt, assistant director of the Forest Products Laboratory, who discussed developments in structural uses of timber. Mr. Markwardt described the various processes by which the strength, weight, hardness, workability, moisture resistance, and other properties of wood can be changed to suit it to new uses, in which it can compete successfully with other materials. Mr. Markwardt illustrated his talk with numerous slides as well as with samples of wood treated by the processes he described. Interest in his talk was attested by an enthusiastic discussion from the floor. Before the dinner meeting adjourned to hear Mr. Markwardt, ASCE Director R. W. Gamble reviewed the accomplishments of the three Society Presidents who held office during his term as Director. He was followed by M. O. Withey, dean of engineering at the University of Wisconsin, who outlined the work of the college of engineering and its plan for expansion.

Student Chapter Notes

TUFTS COLLEGE

RECENTLY REORGANIZED after a one-year period of inactivity, the Chapter at Tufts College has got off to a good start. At one meeting, Oscar Bray, project manager for the Boston firm of Moreland and Jackson, discussed the qualities of character needed for success in the engineering field. Mr. Bray pointed to the facilities of the Society for aiding the engineer and cited its role as intermediary between industry and the engineer. On another occasion, the group attended a meeting of the Boston Society of Civil Engineers and heard Col. Carroll T. Newton, of the Army Corps of Engineers, speak on the "Mississippi River Basin Model."

UNIVERSITY OF FLORIDA

AN INTERESTING mimeographed bulletin is being issued monthly by the University of Florida Student Chapter. The first issue, which appeared in October, announced a contest for the name of the new publication, the prize to be a year's subscription to CIVIL ENGINEERING. With the name, *Civil Gator*, I. M. Huddleston, senior civil engineering student, has won the contest.

In addition to the routine announcements and reports of meetings, *Civil Gator* will cover the news of the engineering school. The dean of the college has written to J. L. Clarke, editor of the publication, saying ". . .I want particularly to commend you and the civil engineering group for getting out this bulletin. It is well planned and most interesting."

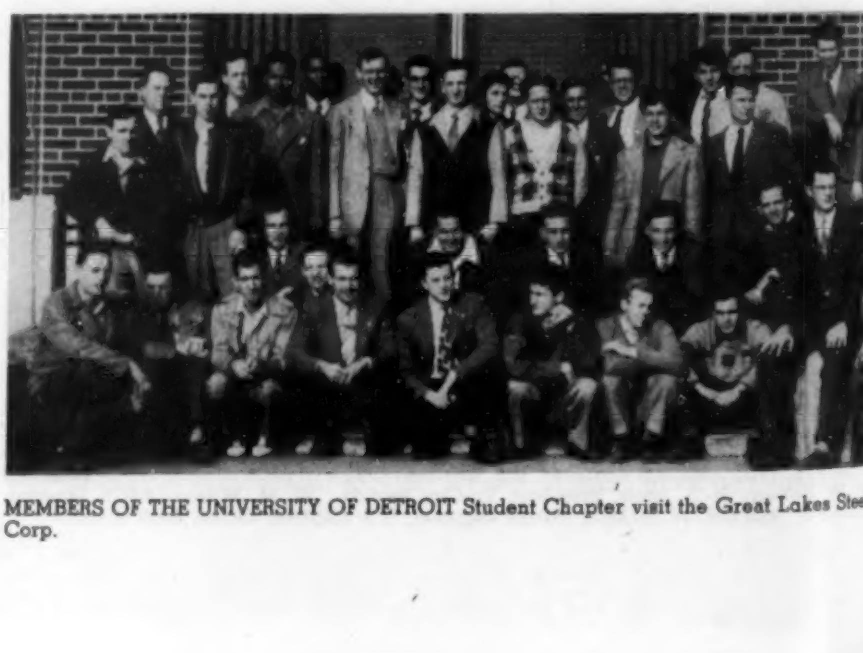
PENNSYLVANIA STATE COLLEGE

THE PENNSYLVANIA STATE COLLEGE Chapter held its second meeting of the fall semester on November 12. Guest of honor and principal speaker was Jacob Feld, New York consultant, who described practical applications of soil mechanics in construction work. This was the first of a projected series of talks sponsored by the Chapter. Other events are in the planning stage, and present indications are that the Chapter will have a banner year.

MEMBERS OF THE STUDENT CHAPTER at Pennsylvania State College hear Jacob Feld, New York consultant, lecture on soil mechanics.

UNIVERSITY OF DETROIT

THE UNIVERSITY OF DETROIT Chapter is enjoying a program of meetings and field trips. The accompanying photograph shows the group on a recent field trip to the plant of the Great Lakes Steel Corp. Points of engineering interest in the Detroit area, including the city water works, are also being visited.



MEMBERS OF THE UNIVERSITY OF DETROIT Student Chapter visit the Great Lakes Steel Corp.

NEWS BRIEFS

ABOUT ENGINEERS AND ENGINEERING

Miami Conservancy District Pays off All Indebtedness

Built following the devastating flood of March 1913 to protect the rich interests of the Miami River valley in western Ohio from a repetition of such a disaster, the Miami Conservancy District project has paid off its total cost, a sum of 45 to 50 million dollars. The entire cost of the project has been met by benefited users, without state or federal appropriations. Maturing bonds must be paid off in 1948 and 1949, but the district already has the funds on hand for this use, according to Col. E. A. Deeds, who has been president of the district since its formation. After October 25, 1946, taxpayers will be required only to pay for the improvement and maintenance of the five earth dams and reservoirs and the levees and flood channels belonging to the district.

The district was established in 1915, the first such agency to be formed under the Conservancy Act passed by the Ohio legislature the previous year. This act was a model for all later conservancy legislation—it provided for the right of eminent domain, for the raising of funds through local participation, and for authorizing of districts to enter into contracts with federal and state governments.

This project—built only after extensive investigations and studies—is noted for its first use of detention reservoirs for flood control. Its facilities were designed and built under the general direction of Arthur E. Morgan, M. ASCE, as chief engineer. Many eminent civil engineers shared responsibility for the success of the project including the following (all Members, ASCE): John W. Alvord, J. C. Beebe, C. A. Bock, Charles B. Burdick, C. H. Eiffert, O. N. Floyd, K. C. Grant, Ivan E. Houk, G. B. Massey, Gerard H. Matthes (Honorary Member), Daniel W. Mead (Past-President and Honorary Member), Charles H. Paul, Ross M. Riegel, and Sherman M. Woodward (Honorary Member).

Emily Warren Roebling Memorial to Be Established

At the suggestion of Dr. D. B. Steinman—in a talk before the Brooklyn Engineers' Club, October 18, 1946, on his book, *The Builders of the Bridge*—the Brooklyn Engineers' Club has launched a drive for the establishment of a memorial to the part played by Emily Warren Roebling in the building of the Brooklyn Bridge. Salvatore Campagna, president of the Brooklyn Engineers' Club, has appointed the following as members of the Emily Warren Roebling Memorial Committee: Walter P. Warendorff (chairman), David Standley, M. ASCE, and Theodore Belzner, Affiliate ASCE.

It will be the mission of this committee to bring the memorial proposal to fruition with the help of other members of the Club and all others interested in symbolizing and recording the part played, without publicity or limelight, by the wives of engineers in making possible many of the achievements of progress.

Tow Job Is Accomplished by Margin of $6\frac{5}{8}$ Inches

Exponents of a larger and modernized Panama Canal are finding firmer footing for their position in the recent "shove-scraping" of the de-Nazified floating crane U.S.S. *Bighook* through the locks, which was accomplished by the use of a powerful Navy tug and a Canal tug for pushing and the usual electric locomotives for pulling. Only by removing her side-rubbing strips was her 109-ft $11\frac{3}{4}$-in. beam sufficiently reduced to give a theoretical $6\frac{5}{8}$-in. clearance between her and the side walls of the 110-ft-wide lock chambers. The great boom of the craft was dismounted and will be brought through later, but even without it, her superstructure towered 120 ft in the air.

The *Bighook* (that's the name sailors have given her—she hasn't received her American name yet), has a 350-ton lifting capacity, 100 tons more than the Canal's German-built (1915) floating cranes, *Ajax* and *Hercules*. The *Bighook* and her three sisters were built in 1938 and rendered important service for the enemy in the submarine pens of Kiel, Bremerhaven and Hamburg. One was sunk in Hamburg harbor, and those allotted to Russia and England sank in the stormy North Sea while being towed to their new destinations.

In 38 days of good weather, Lt. Comdr. R. M. Welpley, USN, with a sea-going tug towing and another standing by, and with a crew of another officer and 21 men plus one German civilian engineer, brought the floating crane to Panama from Bremerhaven.

Her trip through the Canal is reminiscent of similar trips during the war of the great 124-ft-beamed floating steel drydocks U.S.S. *YFD-6* and its twin sister craft. The Pacific fleet sorely needed these Atlantic-side docks. So one by one they were towed to Limon Bay, careened onto their sides (they then became 10-story structures), cross-braced diagonally, and most carefully towed through. This was very tricky navigation in a dry-season trade wind. They were then recareened onto their bottoms at Balboa and put to work.

Despite the resourcefulness and ingenuity of the Navy and the Canal organization, nobody can get England's *Queen Mary* and *Queen Elizabeth* (both transports during the war), or certain American war-built vessels, through at Panama unless a sea-level or larger-locked canal is available. Studies for such a structure are progressing under a 1946–1947 allotment of $1\frac{1}{2}$ million dollars.

(This story has been furnished by Ralph Z. Kirkpatrick of Rochester, N.Y., disability-retired after 28 years on the Canal.)

Removal of Bridge Span Permits Passage of Dredge

CENTRAL SPAN OF LOW BRIDGE is removed to allow dredge to pass into Mission Bay from San Diego River to work on $15,000,000 recreational-area project. Span is floated by barge and rising tide, towed clear of channel and lowered into place later by tide action. Here dredge is towed through opening in bridge with only inches of clearance.

Seven-Point Program for Increase in Construction

IN HIS ADDRESS before the Construction Industry Advisory Council at its November 20-21 meeting in Washington, D.C., James R. Edmunds, Jr., president, American Institute of Architects, outlined a seven-point program designed to expand "the volume of construction as measured on the site, and not in statistics and plans," as follows:

"Free the market of all restrictions and demonstrate that we can meet the housing and other needs of the country without wartime permits, price limitations, allocations, and subsidies. The need for shelter is so basic to human welfare that it must take high precedence in our activities.

"Active and whole-hearted cooperation of manufacturers and distributors to get materials and equipment as rapidly as possible to the sites where they can be used most effectively.

"Cooperation of the financial institutions to the end of starting the immediate construction of those rental dwelling units so badly needed by both veterans and others.

"Cooperation of the design elements—and of contractors and workers. The consumer must be assured that he will receive full value for the money he spends. This means a full day's work for a full day's pay. Labor must realize that restricting its own productivity will, in the long run, result in less rather than more employment.

"Cooperation of all the elements in the industry. We must continually study to improve our product, and to advance the art of construction, and if possible to reduce the cost to the consumer. This means research.

"Cooperation of all the groups in the industry. Building codes must be revised and modernized so that the consumer may be assured of the availability of new methods and new materials.

"Cooperation of all of us. Opportunity for young men must be assured in all branches of the construction industry. This means a well conceived and properly executed training program."

Mr. Edmunds stated that the "inherent inability of a planned economy to furnish the facilities so vitally needed to make up for war deprivations has become clearly apparent to all. The time is ripe for a fundamental change in our thinking."

Moles Announce Year's Construction Awards

THOMAS CRIMMINS, third-generation member of the New York contracting firm bearing his name established almost a century ago, and Harry W. Morrison, president of Morrison-Knudsen Co., Inc., of Boise, Idaho, a participant in the building of Boulder Dam and other outstanding engineering structures, have been nominated by The Moles, New York society of tunnel and heavy construction men, to receive that organization's annual awards to a member and to a non-member "for outstanding construction achievement."

Announcement of the two award winners was made by Carlton S. Proctor, M. ASCE, consulting engineer and chairman of the award committee, and Alfred N. Warwick, Mole's president. Presentation of citations and bronze plaques will be made at The Mole's annual dinner in New York February 5.

EJC Asks Constituents To Back World Conference

THROUGH ITS Committee on International Relations, of which Malcolm Pirnie, New York, Past-President of ASCE, is chairman, Engineers Joint Council is requesting its five constituent societies to participate in a permanent World Engineering Conference. The world conference is to be a continuation of the International Technical Congress, it was decided at a meeting of the congress in Paris last fall, and is to establish a working arrangement with the United Nations Educational, Scientific and Cultural Organization (UNESCO).

The proceedings of the Paris Congress, including all papers printed in English and summaries of the discussions, will be sent to those who participated. Additional sets will be available for sale from the joint Committee on International Relations, 29 West 39th St., New York 18, N.Y.

Among the American engineers who attended the Paris Congress were L. E. Grinter, M. ASCE, Chicago, and Mario Salvadori, Assoc. M. ASCE, New York. The official ASCE representatives were Prof. F. B. Farquharson, M. ASCE, University of Washington, Seattle; and Charles E. d'Ornellas, M. ASCE, Paris, France.

Edison Centennial to Be Marked by Banquet

ENGINEERS throughout the nation will join this year in an extensive program of activities celebrating the 100th anniversary of the birth of Thomas A. Edison. As a tribute to this memorable occasion New York engineers, under the leadership of the N.Y. Section of AIEE, have scheduled a banquet to be held in the Grand Ballroom of The Waldorf-Astoria, February 11.

Former close associates of Mr. Edison, resident in and near New York, will be honored guests. An unusual program is being arranged which will include speakers of prominence in fields embraced by Mr. Edison's inventive genius.

Reservations for this dinner can be made by writing to the Thomas A. Edison Centennial Dinner Committee, 33 West 39th St., New York 18, N.Y.

Clyde E. Williams Named 1947 President of AIME

CLYDE E. WILLIAMS, director of the Battelle Memorial Institute at Columbus, Ohio, has been elected president of the American Institute of Mining and Metallurgical Engineers for 1947, to take office at the annual meeting in March. Two vice-presidents have also been elected: Andrew Fletcher, vice-president of the St. Joseph Lead Co., New York, N.Y.; and Robert W. Thomas, general manager of the Nevada Consolidated Copper Corp., Ray, Ariz.

N. G. Neare's Column

Conducted by

R. ROBINSON ROWE, M. ASCE

"TWO MONTHS ago," recalled the Professor, "our friendly argument about cubes degraded into an auction, after which the highest bid was refused. The question was how many cubes could be drawn thru 7 random points in space and the auction had run from 30 up to the handsome figure of 11,760.

N. G. NEARE

"Cal, you claimed more cubes than that in the 9 cases you had analyzed and promised your bid when the 2 other cases had been tallied. Ready now?"

"I bid 17,640, which is $^1/_2 . 7 . 7!$!" answered Cal Klater. "Those 7's suggest that there may be some simple analysis, but I had to do it step by step. The answers by cases are:

31-20-10	1,680	22-11-10	1,260
31-11-10	1,680	21-12-10	2,520
30-21-10	1,680	21-20-20	2,520
30-20-11	840	21-20-11	2,520
30-11-11	420	21-11-11	1,260
22-20-10	1,260		
		Total.....	17,640

But please, Noah, let's not have a sequel to this teaser! After 3 months of cubistry I'll never play dice again and I can't eat diced carrots without mashing them."

"All right, Cal. Any more bids? Going, going. . . ."

"One minute, Noah," begged Isidore. "I agree with Cal on *possibilities*, but not on *probabilities*. For a random set of 7 points, some of the 17,640 conceivable cubes will be imaginary. To illustrate the point, take 6 points in a plane and ask yourself how many points are determined by intersecting two circles, each fixed by 3 of the given points. The pair of circles can be drawn in 10 distinct ways and each pair *may* intersect in 2 points, giving a possibility of 20 intersections. But sometimes the circles won't intersect. The probabilities would be very difficult to figure."

". . . Gone." concluded the Professor. "Isidore's logic is irrefutable, but I've promised 'no sequels.' I really did expect someone to double Cal's bid, tho. In Riemannian space, the six faces of a cube really bound two cubes—one inside and one outside—just as 3 arcs on a sphere may divide the entire surface into two spherical triangles.

"Before that starts some more bidding, let me introduce Guest Professor Tim Burr, who has promised a new problem. And let me warn you that a burr can really be rough."

"I won't be rough tonite," promised Professor Timothy Burr, "but I'll remind you of the old saying that sometimes one can't see the forest for the trees. Suppose there were a forest of 200 trees per acre, dispersed at random and not in rows, and each tree

was 2 ft in diameter. Then suppose you were in the forest with panoramic horizontal vision, how far, on the average, could you see?"

[*Cal Klaters were Anne Othernut (J. Charles Rathbun), Isidore Knobbe (Joseph S. Lambie) and D. Sy For (Allan N. Newman). Guest Professor Burr is really Charles F. Ruff.*]

Book on Industrial Research Labs Is Issued

RECENTLY ISSUED by the National Research Council as Bulletin No. 113, the eighth edition of the directory, *Industrial Research Laboratories of the United States*, defines industrial research as "the endeavor to learn how to apply scientific facts to the service of mankind." The volume lists and identifies 2,443 laboratories that seem to meet this criterion in their researches.

The present situation in regard to the reconversion of laboratories to a peacetime basis has been taken into account in compiling the present volume, the first since the 1940 edition. Included for the first time in this edition is an appendix, listing colleges and universities that offer research service to industry.

The bulletin may be obtained from the National Research Council, National Academy of Sciences, Washington, D.C. The price is $5.00.

Rep. Hinshaw Addresses ASME Annual Convention

AN ASCE MEMBER, Congressman Carl Hinshaw of California, delivered a luncheon address at the recent annual meeting of the American Society of Mechanical Engineers in New York.

Declaring that the world and the nation are at a critical juncture, he called the engineer, "that unique synthesis of the theoretical and the practical that is so badly needed," and urged engineers to accept their responsibilities in public life.

The address was similar to the one he delivered before the 1946 ASCE Spring Meeting in Philadelphia (see CIVIL ENGINEERING for May 1946, page 201).

U.S. Employment Service Is Augmented by Merger

PLACEMENT SERVICES of the U.S. Employment Service for scientific and professional personnel have been augmented by the merger of the National Roster of Scientific and Professional Personnel with the USES National Clearing House. The Clearing House will operate through the 1,800 local state employment service offices so that registrants with executive, professional, and scientific qualifications and experience may be placed in contact with employers anywhere in the country or overseas.

CAA Issues New Book for Airport Engineers

A COMPREHENSIVE engineering handbook on soils in relation to airport construction, and the use of aerial photographs in selecting airport sites, is now available at a cost of $2 from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

The book, resulting from a cooperative study by the Technical Development Service of the Civil Aeronautics Administration and Purdue University, is entitled "The Origin, Distribution, and Airphoto Identification of United States Soils, with Special Reference to Airport and Highway Engineering." The authors are David S. Jenkins, of the Civil Aeronautics Administration, and D. J. Belcher, L. E. Gregg, and K. B. Woods, of Purdue University. All are members of the Society.

Publication of the handbook coincides with the start of a seven-year federal airport-construction program, and it is expected that it will find wide use among engineers responsible for airport planning and site selection.

Booklet on Slide Rule Short Cuts Published

ENGINEERS AND others who wish to improve their technique with the slide rule will be interested in a recent booklet by W. P. Miller, entitled "Slide Rule Short Cuts with Positive Location of the Decimal Point." The pamphlet explains the "how" and "why" of short-cut methods that save both time and effort in many often-repeated calculations. Simple rules, applying to both the C and CI scales when used against D, eliminate any uncertainty as to the location of the decimal point.

The booklet may be obtained from W. P. Miller, 536 F Street, San Diego 1, Calif., at a cost of $1.50 postpaid.

N. Y. State Board of Examiners Holds Annual Meeting

APPLICATIONS TOTALING 431 were considered at the 267th meeting of the N.Y. State Board of Examiners of Professional Engineers (the annual meeting), held in Albany, N.Y., November 21. Of these applications, 9 were held for further consideration, 1 was rejected, 2 were assigned to the preliminary examinations, 143 were assigned to the complete or final examinations, 247 were approved for license (the applicants having passed the complete examinations), and 29 were approved for license by endorsement or on the basis of long-established standing.

Officers were elected for the ensuing year as follows: D. B. Steinman, M. ASCE, chairman; Newell L. Nussbaumer, M. ASCE, vice-chairman; Newell L. Freeman, secretary.

Conference Called to Discuss Atlanta Hotel Fire

BECAUSE OF the Atlanta Hotel fire and other recent serious hotel fires the National Fire Protection Association is calling a national conference on "Hotel Fire Safety" to be held at 10 a.m. on Thursday, January 16, at the Benjamin Franklin Hotel in Philadelphia. This will be a one-day meeting and all interested groups are being invited to participate.

Since this conference is scheduled at the time of the Society's Annual Meeting in New York, the president of the Philadelphia Local Section has been asked to appoint one of its members to represent ASCE. At the conference an account of Atlanta's Winecoff Hotel fire will be presented and a program designed to provide specific information of concrete value in preventing similar tragedies will be discussed.

New Service Bulletin for CEC Reserve Officers

PUBLICATION OF THE December 1946 issue of *CEC* inaugurates a new service bulletin prepared monthly by the Bureau of Yards & Docks, Navy Department, for distribution to all officers of the Civil Engineer Corps.

The bulletin is not a news magazine, but is an attractive presentation of information for the purpose of maintaining the efficiency of the CEC Reserve officers. By describing the latest developments and techniques of the Bureau of Yards & Docks, the bulletin will keep them up to date on current methods used by the USN, CEC, thus augmenting their usefulness if they are recalled to active service.

Information on Building Materials Now Available

REALIZING THAT the housing shortage and establishment of the Veterans' Housing Program have aroused widespread interest in the production and use of the materials required to implement the program, the Construction Division of the Department of Commerce is presenting a series of nontechnical articles on major building materials in its monthly publication, *Construction and Construction Materials*. The articles outline the history of production and consumption and give estimates of production for the current year.

First in the projected series, the July issue carried a survey of roofing materials. The October number—second in the series—presents a comprehensive study of cement and concrete used in construction. The latter also covers a group of building products for which cement is a basic material, such as concrete blocks, brick and tile, and asbestos cement products. Other articles in the series will appear from time to time in future issues of *Construction and Construction Materials*.

New in Education

Georgia Tech Authorized to Award Doctorates

THE FIRST engineering and scientific courses leading to doctorate degrees in the State of Georgia are now being offered by the Georgia School of Technology. According to a recent bulletin, the Division of Graduate Studies is scheduling 357 courses leading toward master of science and doctorate degrees. Award of the degree of doctor of philosophy in engineering by the School was authorized in February 1946 by the Board of Regents of the University System of Georgia. Curricula leading to the master's degree were authorized in 1922, and the Division of Graduate Studies was organized in 1941.

Because of the highly individual nature of work leading to the doctorate, the dean of graduate studies will assist applicants in determining their fields of specialization. Graduate students applying for this degree are encouraged to undertake research that will benefit the South from an engineering and industrial viewpoint. To assist worthy and qualified graduate students who, for financial reasons, ordinarily would be unable to continue their advanced education, Georgia Tech has available financial aids ranging from $600 to $1,800 per academic year. These include assistantships, instructorships, and fellowships.

ALAN BESSEMER, great-nephew of Sir Henry Bessemer, inventor of the steel-making process which bears his name, is a freshman civil engineering student at Carnegie Institute of Technology, Pittsburgh. The young Englishman, a former RAF navigator and holder of the D.F.C., is standing before a diorama of a blast furnace in Tech's Engineering Hall.

Research Labs Established At Minnesota University

TWO NEW LABORATORIES, one for sanitary engineering research and the other for soils mechanics studies, have been established at the University of Minnesota to operate under the department of civil engineering, of which Dr. Lorenz G. Straub, M. ASCE, is head.

The sanitary engineering laboratory, one of 15 in the United States, will be directed by George J. Schroepfer, Assoc. M. ASCE, professor of sanitary engineering and chairman of the ASCE Sanitary Engineering Division's executive committee. The major part of the equipment required for immediate use has been obtained without cost as surplus property from war plants in the area. While on a modest scale to begin with, the laboratory ultimately will be equipped to perform physical, chemical and biological examinations and demonstrations, particularly for water supply, sewage and industrial waste treatment and garbage disposal—for research as well as for instructional purposes.

Heading the soil mechanics laboratory will be Dr. Miles S. Kersten, Jun. ASCE, assistant professor of civil engineering. Principal uses of the laboratory will be in undergraduate instruction and graduate study and research. Soil mechanics has recently been added to the required course. It is planned to equip this laboratory to run all manner of soil tests important in the design of hydraulic structures, bridges, buildings, embankments, roads, airfields, etc.

Accrediting of Employers

(Continued from page 13)

ing it operate well. It seems a simple way to clean our own house and the decent way to retain title to our professional claims.

With the recognition of accredited employers, those who were unaccredited would suffer the stigma now attached to unaccredited colleges. When engineers and technical men become as unwilling to accept jobs from unaccredited employers as they are unwilling to accept instruction from unaccredited institutions—our goal will be won. We will have something then which will be far more effective than argument or even a threat to strike—after employment.

On the employer's side, once accredited, he need have no worries about any question of his wages and working conditions or of the duties of his engineering employees—he would have peace and could plan in peace. And accredited employers will have the pick of all engineers seeking employment.

This is a plan to maintain professional independence by clothing engineering employment with the distinction of professional standards. It requires that we accept the responsibilities of supporting that distinction. Of the need for such an objective, I have no doubts. If there are better ways to gain it, let's have them. But let's judge this plan quickly and let's work it out fast if it meets our aims and our ethics. For there is a big job to be done—but none too big for this profession if it sets out whole-heartedly to do it.

News of Engineers

C. Earl Webb has been appointed chief engineer of the American Bridge Co., with headquarters in Pittsburgh. Mr. Webb has been connected with the organization since 1914 and has been Western division engi-

Charles F. Goodrich

C. Earl Webb

neer at Chicago since 1935. He succeeds **Charles F. Goodrich,** former Director of the Society, who is retiring after 40 years of service with the company. Mr. Webb's former position as western division engineer for the American Bridge Co. is being filled by **Albert P. Boysen,** previously designing engineer in the Chicago office.

Philip B. Fleming, major general, Army Corps of Engineers and Federal Works Administrator, has been appointed head of the Office of Temporary Controls—an organization created to liquidate wartime agencies.

Cornelius W. Kruse has been appointed associate professor of sanitary engineering at the Johns Hopkins School of Hygiene and Public Health. Until recently he was associate sanitary engineer in the Health and Safety Department of the Tennessee Valley Authority.

George Jacob Davis, Jr., recently retired as dean of the University of Alabama engineering college. He had been on the staff of the university since 1912.

Norman B. Newcomb has severed his connection with the Kellex Corp., at Knoxville, Tenn., to become superintendent of construction for the National Gypsum Co. Mr. Newcomb's work with the Kellex Corp. included a period as head of the structural division that built the gaseous diffusion plant at Oak Ridge, Tenn., for the concentration of uranium.

Roy K. Van Camp is now city engineer of Tampa, Fla. He was previously assistant area engineer in the U.S. Engineer Office at Hialeah, Fla.

Charles Church More, for many years professor of structural engineering at the University of Washington, is being signally honored by the Washington Board of Regents, which has named the new civil engineering building under construction on the University of Washington campus the Charles Church More Building.

Hubert K. Bishop, formerly deputy commissioner of the Public Roads Administration, has joined the American Road Builders' Association as manager of the County Highway Officials Division and the Municipal Division, with headquarters in Washington, D.C. Well known in the field of highway engineering, Mr. Bishop served as chief engineer of the Indiana State Highway Commission and first deputy New York State highway commissioner before joining the Public Roads Administration. In his new capacity he succeeds **John A. Long,** who resigned to become executive secretary of the Florida State Builders Association at Tallahassee.

Hubert K. Bishop

William T. Wright, recently released from service in the Navy, has returned to his former position as head of the engineering division of Kistner, Curtis and Wright, architects and engineers of Los Angeles and San Diego, and will become a member of the firm. During his five years of active Naval duty, Mr. Wright advanced to the rank of captain, and received the Legion of Merit for outstanding service.

Lloyd D. Knapp, superintendent of sewers for the City of Milwaukee, is one of four new directors of the Engineers' Society of Milwaukee, elected at the recent annual meeting of the organization.

Merritt S. Dunlap, after five and a half years as an officer in the Army Corps of Engineers, has gone into business as a general building contractor at South Gate, Calif. Mr. Dunlap is also West Coast representative of the Chicago firm of Consoer, Townsend & Associates. At the time of his separation from the service, he had the rank of lieutenant colonel.

Sidney P. Lathrop has established an engineering practice in Portland, Ore. The new firm, which will be called Sidney F. Lathrop & Associates, will specialize in serving builders and architects. Mr. Lathrop was formerly associated with the Frank Watt Construction Co.

Walter Hovey Hill has been reelected probate judge and ex-officio clerk of the Probate Court, Idaho County, Idaho, for a two-year term. His office will be in Grangeville, the county seat.

William T. Ingram, of Berkeley, Calif., has been appointed engineering field associate on the staff of the American Public Health Association. Colonel Ingram's previous experience includes work with the U.S. Public Health Service and the United Nations Relief and Rehabilitation Administration.

E. Warren Bowden was recently elected to the Board of Directors of Walter Kidde Constructors, Inc., of New York. Mr. Bowden has been associated with Kidde Constructors since 1943, and is vice-president in charge of project engineering.

John S. Bethel, sanitary engineer for the Boston firm of Metcalf and Eddy, was recently awarded the Army Commendation Ribbon for his wartime service as assistant engineer of branch and chief of the sanitized section, utilities branch, Office Service Command. At the time of his release from the Army, Mr. Bethel had the rank of major.

William K. Greene has been promoted from the position of designing engineer in the New York office of the American Bridge Co., to that of assistant division engineer of the Chicago district. In his new capacity he succeeds **Thomas Andrew Jordan,** who recently retired after more than 35 years of service.

Philip Z. Kirpich, following his release from the Army Service Corps, has accepted the position of senior designer for Ebasco Services, Inc., of New York City. Mr. Kirpich was in the Army for three years, attaining the final rank of captain.

Paul Rogers has established a structural engineering practice in Chicago. Until lately Mr. Rogers was designing engineer for the Roberts & Schaefer Co.

Henry Rockwood is now in charge of the U.S. Weather Bureau office in Pittsburgh, the position representing a promotion from that of regional hydrologic engineer at Fort Worth, Tex.

Eugene Reybold, former Corps of Engineers officer and wartime Chief of Engineers, heads a commission of three, appointed by the Chinese government to go to China and study Yellow River problems with a view to recommending future procedure for the control and utilization of the Yellow River. The other members of the commission are **J. P. Growdon,** chief engineer of the Aluminum Company of America, and **J. L. Savage,** for many years chief design engineer of the U.S. Bureau of Reclamation.

Burton G. Dwyre, at one time state highway engineer of New Mexico, has been appointed acting state highway engineer by the New Mexico State Highway Commission.

O. J. Porter, for the past 23 years with the California Division of Highways, has established a private consulting practice in Sacramento under the name, O. J. Porter & Co. The firm will specialize in foundation, pavement, and drainage problems. Widely known as a soils engineer, Mr. Porter recently served on the Army Engineers Board of Consultants on Airfield Pavement Design. Associated with him in the new firm are ASCE members, **W. H. Jervis** and **H. R. Cedergren.** Mr. Jervis was formerly head of the soils embankment section of the U.S. Waterways Experiment Station at Vicksburg, and Mr. Cedergren was previously in charge of the soils department in the U.S. Engineer Office at Portland.

Benjamin R. Wood, until lately chief engineer in the Office of the Chief of Engineers, Washington, D.C., has been transferred to the North Pacific Division of the U.S. Engineer Office at Seattle, where he will serve in a similar capacity. He is being replaced as chief engineer in the Office of the Chief of Engineers, by **Raymond W. Stuck,** formerly chief of the engineering division, South Atlantic Engineer Division at Atlanta.

Francis S. Friel, vice-president and treasurer of the Philadelphia consulting firm of Albright and Friel, has been elected president of the Federation of Sewage Works Associations for the coming year. Mr. Friel is immediate past-president of the Philadelphia Section, and during his term of office headed the committee in charge of the highly successful 1946 Spring Meeting of the Society.

Francis S. Friel

Herbert A. Davies has been promoted from the position of manager of the Birmingham, Ala., plant of the Virginia Bridge Co. to that of vice-president and general manager of the organization, with head offices in Roanoke, Va. Mr. Davies has been associated with the company and its predecessor, the Virginia Bridge and Iron Co., since 1903.

Robert C. Kennedy, assistant chief engineer of the Eastbay Municipal Utilities District, Oakland, Calif., was recently elected president of the California section of the American Water Works Association. Another ASCE member—**Ray L. Derby,** assistant sanitary engineer for the Los Angeles Department of Water and Power—was reelected secretary-treasurer.

Clarence J. Derrick has been appointed to the Los Angeles Board of Public Works. In this new capacity he succeeds **Carl B. Wirsching,** who has accepted the position of city manager of Long Beach, Calif. Both are veterans of the Army Corps of Engineers.

DECEASED

John Henry Burgoyne (M. '29) retired engineer of Hampton, N.H., died suddenly on November 1, while visiting at Troy, N.Y. He was 68. At the outset of his career, Mr. Burgoyne spent two years in the employ of the Erie Railroad. He then (1904) went to South America, where for many years he was engaged in supervising the construction of railways and mining installations in Peru, Chile, Bolivia, the Argentine, and Brazil. Since his retirement in 1942 he had lived at Hampton, N.H.

Henry Colosimo (Assoc. M. '36) chief engineering draftsman for the Army Transport Service, Brooklyn, N.Y., died on October 25. In a few days he would have been 49. Born and educated in Italy, Mr. Colosimo spent his early career there, coming to the United States in 1925. Here he was with the architectural firm of Hillberg & LaVelle on the construction of the Washington memorial portal to Brooklyn Bridge, and from 1929 to 1933 was topographical draftsman for the Lawyers Title & Guaranty Co. Later Mr. Colosimo was an engineer in the Health Department of the WPA, and in 1942 he joined the design unit of the Army Transport Service.

William Chester Emigh (M. '42) city engineer of Coatesville, Pa., died on September 26, at the age of 58. From 1916 to 1919 Mr. Emigh was with Henry W. Taylor, consulting engineer; from 1920 to 1922, in the engineering service of New York State; and from 1922 to 1931, at the Coatesville plant of the Bethlehem Steel Co. Since 1931 he had been city engineer of Coatesville.

Charles Needham Forrest (Assoc. M. '09) retired chemical engineer of Cranford, N.J., died at Fort Myers, Fla., on December 2, at the age of 70. Early in his career Mr. Forrest was an assistant chemist for the Baltimore & Ohio Railroad and chemist for the Long Island Railroad. In 1904 he became chief chemist for the Barber Asphalt Corp., of Perth Amboy, N.J., and in 1914 was made manager of the technical department of the organization. From 1926 until his retirement in 1941, he served as consulting chemist to the corporation. Mr. Forrest was active in research work on road and paving materials and waterproofing compounds, and had written many technical papers and reports on these subjects.

Carleton Mills Fyler (Assoc. M. '30) who served in the Navy Civil Engineer Corps during the war, died at his home in Toledo, Ohio, on November 24. He was 50. From 1923 to 1930, Mr. Fyler was in the Toledo City Engineer's Office, serving successively as assistant engineer of bridges, acting engineer of bridges, and engineer of bridges. From 1930 to 1934 he was with the consulting firm of Modjeski, Masters, and Chase. He then spent three years in private practice in Toledo, and later was in charge of the engineering revaluation of all property in Lucas County, Ohio. In 1943 Mr. Fyler became a lieutenant in the Navy.

Fred Hesse (M. '08) consulting engineer of Portland, Ore., died on November 1, at the age of 76. Although a native of Germany, Mr. Hesse had spent much of his engineering career here. He had been manager and chief engineer of the Oregon Foundry at Portland, and from 1911 to 1932 was manager and chief engineer of the Hesse-Martin Iron Works. Later he was engineer for the Columbia Construction Company on the construction of Bonneville Dam, and for Consolidated Builders, Inc., on Grand Coulee Dam. Since 1938 he had had a consulting practice in Portland.

Chester James Hogue (M. '11) in charge of the Technical Service, West Coast Lumbermen's Association, Seattle, Wash., died early in November. Mr. Hogue, who was 71, had been with the West Coast Lumbermen's Association since 1916. Early in his career (1899 to 1913) he was engaged on reinforced concrete design and construction in Boston, and from 1913 to 1916 he maintained an engineering and architectural practice in Portland, Ore. Mr. Hogue was the author of several books on the use of wood, and of numerous studies on reinforced concrete.

Thomas Mero McClure (M. '38) state engineer of New Mexico, Santa Fe, died on November 5. Mr. McClure, who was 51, had been New Mexico state engineer since 1930. Earlier in his career (1922 to 1925), he was project engineer for the New Mexico State Highway Department, and from 1925 to 1930 assistant engineer for the International & Great Northern Railway Co.

Allen Shelly McMaster (Assoc. M. '22) assistant professor of engineering mathematics at the University of Colorado, died on May 23, 1946, according to word that has just reached the Society. Mr. McMaster, who was 53, had been at the University of Colorado for the past twenty years. Prior to that he was resident engineer on highway work in Texas, and during the first World War served in the Army Corps of Engineers.

Fred Lawrence Moore (M. '32) of Hempstead, N.Y., died in April 1946, according to word just received at Society Headquarters. He was 53. From 1922 to 1931 Mr. Moore was office manager, specification writer, and general superintendent for C. B. Comstock on $100,000,000 worth of industrial construction. Later he was building inspector for the village of Garden City, N.Y., and from 1936 to 1944 was director of engineering for the Quality Bakers of America. During the first World War Mr. Moore served overseas as purchasing officer for the 20th Engineers.

William Francis Newbery (M. '21) member of the Philadelphia firm, the William F. Newbery Co., died on March 28, 1946, according to word just received at Society Headquarters. Mr. Newbery, who was 62, had been in private practice in Philadelphia since 1916. During this period he specialized in the design and construction of manufacturing and commercial buildings, warehouses, and industrial plants. Earlier in his career (1905 to 1913), Mr. Newbery was chief engineer for John G. Brown, of Philadelphia, on the design and construction of industrial structures.

Richard Fuller Newton (Jun. '44) of Dorchester, Mass., died at his home there on November 14, after a long illness. He was 24 years old, and a civil engineering alumnus of Northeastern University, class of 1943.

Otto John Raiffeisen (M. '43) supervising engineer for the Gulf Oil Corp., Pittsburgh, Pa., died on October 22, at the age of 59. Mr. Raiffeisen had been with the Kansas City Structural Steel Co., the Oklahoma Iron Works, the Arizona Copper Co., and the Fort Pitt Bridge Works. In 1924 he became design engineer for the Gulf Oil Corp., and he has been supervising engineer since 1933.

Thomas Bryan Whitney (M. '10) of Milford, Pa., died on November 10, at the age of 71. Although born in France, Mr. Whitney was educated in the United States and spent his engineering career here. From 1904 to 1917 Mr. Whitney was with the Hudson & Manhattan Railroad of New York, serving successively as engineer of design and engineer of way and structures. In 1918 he became assistant engineer for the Erie Railroad, and later was office engineer for the New York region of the Erie. Of more recent years Mr. Whitney had been with Cuddeback & Co., of Milford.

Louis Yager (M. '19) assistant chief engineer for the Northern Pacific Railway, St. Paul, Minn., died in a hospital there on November 22. He was 69. Mr. Yager had spent his entire career with the Northern Pacific, having gone there as a rodman in 1900. One of his early jobs was as assistant engineer on the construction of the St. Louis Bay bridge project at Duluth. He was made division engineer at St. Paul in 1910, and became assistant chief engineer in 1922. During the first World War, Mr. Yager was called to Washington as chief maintenance-of-way engineer for the U.S. Railroad Administration. In 1943 he was in Washington again, serving in the transportation equipment division of the War Production Board. Mr. Yager was a member and past-president of the American Railway Engineering Association.

Changes in Membership Grades

Additions, Transfers, Reinstatements, and Resignations

From November 10 to December 9, 1946, Inclusive

ADDITIONS TO MEMBERSHIP

AKEL, MAJED A. (Jun. '46), Junior Structural Engr., H. K. Ferguson, Inc., Engrs., Ferguson Bldg., 11th and Walnut (Res., 155 East 291st St.), Willoughby, Ohio.

ALLEN, GEARY M., JR. (Jun. '46), 3120 Draxten Ave., Route 3, Albuquerque, N.Mex.

BAKER, STANLEY JAY (Jun. '46), Engr., Bridge Dept., State Road Comm., Room 427, State Capitol Bldg. (Res., 1054 Roosevelt Ave.), Salt Lake City 5, Utah.

BARGER, CHARLES WILLIAM, JR. (Jun. '46), Mgr., Chas. W. Barger & Son, Lexington, Va.

BAUKOL, PHILIP JULIN (Assoc. M. '46), Mech. Engr., Myron C. Gould Associates, 701 Sansome St., San Francisco (Res., 2371 Virginia St., Berkeley 9), Calif.

BEARMAN, ALEXANDER ALFRED (M. '46), Chf. Engr., 20th Century-Fox Film Corp., 444 West 56th St., New York 19, N.Y.

BENITEZ REXACH, FELIX, JR. (Jun. '46), Dredge Supt., Felix Benitez Rexach, Civ. Engr. & Contr., Obras Portuarias, Puerto Plata, Republica Dominicana.

BREDOW, PAUL FREDERICK (Jun. '46), Ensign, CEC, U.S.N.R., 103d Naval Constr. Battalion, Care, Fleet Post Office, San Francisco, Calif.

BROWN, PHILIP PROCTOR (Jun. '46), Research Asst., Dept. of Eng., Princeton Univ. (Res., 13 Upper Pyne), Princeton, N.J.

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Juniors	6,394
Affiliates	76
Fellows	1
Total	21,216

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Mailing and Publications to ☐ Home ☐ Business

Listing in Yearbook to include:

☐ Home only ☐ Business only ☐ Home and Business

SHERMAN, STEWART ISRAEL (Assoc. M. '33; M. '46), Civ. Engr., Bureau of Eng., Board of Estimate, City of New York, Room 1347 Municipal Bldg., New York 7, N.Y.

SMITH, HARRISON (Assoc. M. '14; M. '46), (Sanderson & Porter), 52 William St., New York 5, N.Y.

SMITH, RALPH ALBERT (Assoc. M. '36; M. '46), (Consoer, Townsend & Associates, Cons. Engrs.), 211 West Wacker Drive (Res., 1400 Lake Shore Drive), Chicago 10, Ill.

SHUMAN, EVERETT CARLYLE (Assoc. M. '39; M. '46), Research and Development Supervisor, Owens Illinois Glass Co., Berling, N.J.

SPORSEEN, STANLEY EMANUEL (Jun. '33; Assoc. M. '37; M. '46), Senior Engr., U.S. Army Engrs., 628 Pittock Block (Res., 1395 North East 49th Ave.), Portland 13, Ore.

STAUBACH, ARNOLD BALDWIN (Assoc. M. '35; M. '46), Senior Designing Engr., State Highway Dept., Highway Bldg. (Res., 3406 Windsor Road), Austin 21, Tex.

STONEBURNER, CLIFTON GODFREY (Jun. '35; Assoc. M. '46), Highway Engr., Arlington County, Court House (Res., 4631 Third St., South), Arlington, Va.

THOMPSON, ROBERT ANDREW, JR. (Jun. '25; Assoc. M. '31; M. '46), Senior Engr., U.S. Engr. Dept., San Antonio Suboffice, Fort Sam Houston (Res., 414 West Rosewood, San Antonio 1), Tex.

THRAPP, HARRISON FRANCIS (Jun. '37; Assoc. M. '46), Comdr., CEC, U.S. Navy, 18th and Constitution Ave. (Res., 3445 Thirty-eighth St., N.W.), Washington 16, D.C.

TUSKIND, EUGENE RANDALL (Assoc. M. '37; M. '46), Engr., Surveys and Plans, State Highway Dept., Capitol Bldg. (Res. 110 Ave. D., East), Bismarck, N.Dak.

TUTTLE, JAMES MASON (Jun. '38; Assoc. M. '46), Designing Engr., Frederic R. Harris Eng. Corp. Daylight Bldg., Knoxville, Tenn.

VANDEN BERG, JOHN LLOYD (Jun. '36; Assoc. M. '46), Asst. Highway Engr. P-2, Public Roads Administration, 303 Old Post Office Bldg. (Res., 2624 North Grant St.), Little Rock, Ark.

WAGNER, WARREN ORVAL (Jun. '34; Assoc. M. '46), Asst. Prof. of Hydraulics and Research Project Supervisor, California Inst. of Technology, Pasadena 4, Calif.

WARREN, FREDERICK HAYES (Jun. '36; M. '46), Asst. Director, Office, Defense Plants, Reconstruction Finance Corp., Room 835 Lafayette Bldg. (Res., 4328 Verplanck Place, N.W.), Washington, C.C.

WATSON, JOHN DARGAN (Jun. '28; Assoc. M. '38; M. '46), (Watson & Hart, Cons. Engrs.), 216 West Market St., Greensboro, N.C.

WHITE, ROSSITER LAWRENCE (Jun. '40; Assoc. M. '46), Civ. Engr., Los Angeles County Flood Control Dist., 751 South Figueroa St. (Res., 1715 Echo Park Ave.), Los Angeles 26, Calif.

WHITE, SARGENT (Jun. '31; Assoc. M. '37; M. '46), Senior Engr., Office, Defense Plants, Reconstruction Finance Corp., Contract Termination Section, Washington, D.C. (Res., 809 Fulton Ave., Falls Church, Va.)

WILLCOMB, ROLAND HOWARD (Assoc. M. '19; M. '46), Administrative Aid and Comm. Secy., State Highway Comm., East 6th Ave. and Roberts (Res., 42 Helena Apartments), Helena, Mont.

REINSTATEMENTS

ARCHER, JAMES HENRY, Assoc. M., Asst. Engr., State Highway Dept., 2 Capitol Square, Atlanta, Ga., reinstated Nov. 22, 1946.

BALOFF, NICHOLAS, Assoc. M., Bridge Engr., U.S. Public Roads Administration, Room 855 Phelan Bldg., San Francisco 2, Calif., readmitted Oct. 21, 1946.

BARNETT, THOMAS EDWARD, Jun., 2906 Naylor Road, S.E., Washington, D.C., reinstated Nov. 8, 1946.

BRITTON, JOHN CLAUDE, Jun., 406 West Atwood St., Galion, Ohio, reinstated Nov. 22, 1946.

CAVANAGH, GERARD JOSEPH, Jun., Care, Engineering Design, Industrial Engrs., 122 South Jackson St., Room 5, Roseburg, Ore., reinstated Nov. 8, 1946.

CRENSHAW, BERNARD LEE, M., Regional Engr., Office of Defense Plants, Reconstruction Finance Corp. (Res., 3551 Thirty-ninth St., N.W.), Washington 16, D.C., reinstated Nov. 15, 1946.

ELLIOTT, ARCHER THOMAS, Jun., 2257 South Downing, Denver, Colo., reinstated Nov. 30, 1946.

FREESTONE, GEORGE STANLEY, Assoc. M., Oil Co. Executive, Five C Refining Co., Transamerica Bldg., Los Angeles (Res., 2084 North Roosevelt Ave., Altadena), Calif., reinstated Dec. 2, 1946.

JOHNSON, ROBERT COLTON, M., Capt., CEC, U.S. N.R., Quarters D, U.S. Naval Air Station, Jacksonville, Fla., reinstated Nov. 26, 1946.

JOYCE, JOSEPH PETER, JR., Jun., Structural Designer, Bridge Div., State Dept. of Highways, 160 North La Salle St. (Res., 410 North Humphrey Ave.), Oak Park, Ill., reinstated Nov. 19, 1946.

LOPEZ HARRISON, MANUEL EUGENIO, Assoc. M., Subsecretario de Fomento, Salvador Govt., 1a Calle Poniente No. 67, San Salvador, Salvador, reinstated Nov. 30, 1946.

MULHOLLAND, JACK, Assoc. M., Cons. Engr., 3d Floor Union Bank Chambers, Queen St., Brisbane B6, Queensland, Australia, reinstated Nov. 30, 1946.

REID, LINCOLN, Assoc. M., Prof., Cornell Univ., Lincoln Hall, Ithaca, N.Y., reinstated Nov. 18, 1946.

SCHENDEL, ALVIN CHRISTIAN, Jun., 1332 North Irving Ave., Minneapolis, Minn., reinstated Nov. 21, 1946.

STAHL, LADDIE L., Jun., Major, Field Artillery, U.S. Army, 32d Field Artillery Battalion, 1st U.S. Infantry Div., Army Post Office 1, New York, N.Y., reinstated Nov. 14, 1946.

STOCK, ELDON MARK, Assoc. M., Lecturer, Civ. Eng., Univ. of California (Res., 1360 Ada St.), Berkeley 2, Calif., reinstated Oct. 10, 1946.

WALTERS, FRANCIS PATRICK, Assoc. M., Care, Wm. Casey & Sons, 215 East 149th St., New York 51, N.Y., reinstated Nov. 12, 1946.

WHITE, FRANK PAUL, Assoc. M., Col., Corps of Engrs., U.S. Army, Engr. Div., Headquarters, Tactical Air Command, Langley Field, Va., reinstated Nov. 14, 1946.

RESIGNATIONS

MORRIS, IRVIN DANIEL, Jun., 324 East 3d St., Colville, Wash., resigned Nov. 14, 1946.

Applications for Admission or Transfer

January 1, 1947 Number 1

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board. Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

Grade	General Requirement	Age	Length of Active Practice	Responsible Charge of Work
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years
Associate Member	Qualified to direct work	27 years	8 years	1 year
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years

APPLYING FOR MEMBER

BELOTE, EARL SAUNDERS (Age 40) U.S. Coast & Geodetic Survey, Washington, D.C.; address, New York City.

BHAGAT, DEEPEHAND GHANSHAMDAS (Age 40) Executive Engr., PWD, Sind, India; address, Karachi, India.

BUHR, VICTOR WILLIAM (Age 48) Senior member of firm, Victor W. Bühr Associates, Salisbury, Md.

BULOT, FRANCIS HENRY (Age 56) Member of firm Bulot & Dondro, Beverly Hills, Calif.

DAMES, TRENT RAYSBROOK (Assoc. M.), Dames & Moore, Foundation Engineering and Applied Soil Mechanics, Los Angeles, Calif.

DORNBLATT, BERNHARD (Assoc. M.) (Age 44) Member of firm, B. M. Dornblatt & Associates, Inc., New Orleans, La.

DURRANI, NASRULLAH (Age 41) at present studying engineering conditions in United States and United Kingdom for Govts. of Madras and India.

ELLIOTT, DABNEY OTEY (Age 56) Div. Engr., Great Lakes Engr. Div., Chicago, Ill.

GRAFTON, ELDON CARLYLE (Age 45) Transportation Engr., GHQ Allied Powers, Japan.

HOYNCK, LEO ADOLPH (Assoc. M.) (Age 64) Bemis Bros. Bag. Co., St. Louis, Mo.

JOHNSON, ARTHUR HILL (Age 52), Associate Engr., Div. of Water Power & Control New York State, Huntington, N.Y.

KAMATH, MULKI NARAYANA (Age 45) with Madras (India) Road Engrs. Delegation to visit United States and United Kingdom to study engineering methods.

KANTAWALA, KANTILAL MENEKLAL (Age 36) Road Engr. on deputation for Govt. of India to study modern methods of construction in United Kingdom and United States; Bombay, India.

LEATHERWOOD, REUBEN FRANCIS (Age 41) Senior Engr., Office of Chf. of Engrs., Washington, D.C.

McKAY, PAUL JOSEPH (Age 46) Dist. Constr. Engr., State Dept. of Highways, Vancouver, Wash.

MEARA, FRANCIS LEO (Age 45) Prin. Engr., U.S. Engr. Office, Baltimore, Md.

MESSNER, EDWARD GRANT (Age 49) Chf. Engr., Dept. of Aviation, Alleghany County, Pittsburgh, Pa.

MUGNIER, ALSTON DELAP (Age 45) Project Engr., Holyoke (Mass.) Water Power Co., Holyoke, Mass.

MUKERJEE, AMULYA CHANDRA (Age 48) Superintending Engr., PWD, United Provinces, India, Lucknow, India.

MURTAZA, SAYAD GHULAM (Age 46) Executive Engr., PWD, Sukkur, India.

NAMBIAR, KOTTAYAM KATANKOTAN KUNHIRAMAN (Age 44) City Engr., Madras (India) Corp., Madras, India.

OMSTED, HARALD (Assoc. M.) (Age 46) Senior Structural Engr., J. M. Montgomery & Co., Los Angeles, Calif.

ORDWAY, EDWARD SCHILLING (Age 45) Engr., Havens & Emerson, New York City; address Oradell, N.J.

PEEPLES, HENRY COOK (Age 58) With TVA, Chattanooga, Tenn.

PINE, LYNN WILSON (Assoc. M.) (Age 37) U.S. Engr. Office, San Francisco, Calif.

REED, LINWOOD EDWARD (Age 50) with Potomac Elec. Power Co., Washington, D.C.

ROOS, SIGMUND (Assoc. M.) (Age 40) Structural Engr., Clarke, Rapuano & Holleran, Cons. Engrs. and Landscape Archts., New York City.

SAUER, ARTHUR ALBERT (Assoc. M.) (Age 46) Cons. Structural Engr., Sacramento, Calif.

SRI-RANGA-CHARY, GOMATAM (Age 43) On deputation (Govts. of Madras and India) to study soil mechanics and stabilization in United Kingdom and United States.

STANGER, ROY ARMOUR (Age 44) Service Engr., Portland Cement Association, North Little Rock, Ark.

SWENDSEN, WARREN GIBBS (Assoc. M.) (Age 68) Pres. and Gen. Mgr., Intermountain Equipment Co., Boise, Idaho.

TODD, LAZARUS HOUSTON (Jun.) (Age 37) Major, U.S. Army, Office of Chf. of Engrs., Washington, D.C.

TRIMPI, ALLAN LITTELL (Assoc. M.) (Age 58) Special Eng. Asst., New Jersey Dept. of Conservation, Chatham, N.J.

TROTTER, ROBERT MICHAEL (Age 40) Asst. Gen. Mgr., Great Lakes Dredge & Dock Co., Chicago, Ill.

WITTMAN, MERRILL BLAIR (Age 45) Res. Engr. with City of El Centro, Calif.

WYMORE, ALLAN HYDE (Age 39) Jun. Associate Engr., Burns & McDonnell Eng. Co., Kansas City, Mo.

APPLYING FOR ASSOCIATE MEMBER

ABRAHAM, JAMES GLADSTONE (Age 34) On deputation by Govts. of Madras and India for advanced training in highways and bridges in U.K. and U.S.

ADAMS, SHAROLD EVERETT (Jun.) (Age 35) Engr. P-2, Bureau of Reclamation, U.S. Dept. of Interior, Ft. Collins, Colo.

ALMDALE, THOROLF RUSSELL (Age 29) with Greeley & Hansen, Engrs., Chicago, Ill.

BENHAM, DAVID BLAIR (Age 28) Benham Eng. Co., Oklahoma City, Okla.

CARSON, CHESTER PEYTON (Jun.) (Age 32) Senior Partner, Carson-Mitchell, Engrs., Springfield, Mo.

CRIMMINS, ROBERT (Age 31) Superv. Engr., Thomas Crimmins Constr. Co., New York, City.

CURTIS, ARNOLD (Jun.) (Age 34) Traffic Mgr. and Chf. Expediter, R. J. Dunlap Co., Riverside, Calif.

DICK, DAVID (Age 30) Civ. Engr., Tennessee Eastman Corp., Kingsport, Tenn.

DULLY, HOWARD FRANKLIN (Jun.) (Age 31) Southern Pacific Co., Portland, Ore.

DUTT, ANIL CHUNDER (Age 39) Asst. Engr., Works & Bldgs. Dept., Bengal, India; address, Calcutta, India.

FALKIN, MURRAY (Jun.) (Age 27) Structural Draftsman with O. H. Ammann, Cons. Engr., New York City.

FARRAR, ROGER MACY (Jun.) (Age 35) Civ. Engr., Grade 1, Creole Petroleum Corp., El Sombrero, Venezuela.

FOUST, CLARENCE T. (Age 40) Senior Engr., Chf. of Civ. Constr. Branch, U.S. Engr. Office, Cincinnati, Ohio.

HALES, ALBERT JOSEPH (Jun.) (Age 33) Hersey Inspection Bureau, Oakland, Calif.

HARVEY, RICHARD THOMPSON (Age 40) U.S.E.D., Buffalo, N.Y.

HOUSEMAN, JOHN ALBERT (Age 35) Private practice, design and consultation, Dallas, Tex.

JOHNSON, CARL ERIK (Jun.) (Age 35) Member of firm, Johnson & Cothern, Ft. Myers, Fla.

KHAN, HATEM ALI (Age 36) Member of delegation sent by Govt. of India to U.S. and U.K. to study Highway Eng.; address Calcutta, India.

KOCHHAR, RAJENDRA KUMAR (Age 33) With PWD, United Provinces of India, Lucknow, India.

KULHAN, EDWARD FRANK (Jun.) (Age 31) U.S. Army (hospitalized), Washington, D.C.

LESLIE, ROBERT (Age 33) Senior Engr. with Ninham Shand of Stewart, Shand & Oliver, chartered Cons. Engrs., Cape Town, South Africa.

MAIERLE, JOSEPH ADOLPH (Age 41) Morrison Eng. Co., Helena, Mont.

MEYERS, WAYNE DELMONT, JR. (Age 34) Engr., Dravo Doyle Co., Pittsburgh, Pa.

MISRA, KEDAR NATH (Age 32) Member, Indian Govt. Ry. Engrs. Deputation, at present in United States.

MITRA, AKHIL CHANDRA (Age 46) Superintending Engr., Nayar Dam Scheme, PWD, Govt. of United Provinces, India, Lucknow, India.

MOLMEN, OTTO (Age 47) Sec. Head, American Gas & Elec. Service Corp., New York City.

MORTENSON, CLIFFORD NELSE (Jun.) (Age 35) United Constr. Co., Seattle, Wash.

NEUMANN, ERNEST LESLIE (Jun.) (Age 34) City Mgr., Oak Park, Mich.

OFFICER, JOHN DAVID (Age 35) Asst. Project Engr., Hungry Horse Dam, USBR, Kalispell, Mont.

PANI, MADHAB CHANDRA (Age 35) Govt. of India Road Engr. on deputation to U.K. and U.S. to Study methods of road construction; address Cuttack, Oressa Province, India.

PLATH, ALBERT JOHN (Age 42) Engr., U.S. Engr. Office, Galveston, Tex.

PRESCOTT, HAROLD STURTEVANT (Age 39) Associate Engr., Eng. Div., U.S. Engr. Office, Providence, R.I.

REDDY, KILANGIPET RAMASWAMY (Age 38) On deputation for Govt. of India for advanced study of concrete and concrete construction in United Kingdom and United States, Chittoor, S. India.

REPSIS, ANTHONY CHARLES (Age 34) Civ. Engr., E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

RIPPERGER, EUGENE ARMAN (Age 32) Special Instructor, Univ. of Texas, Austin, Tex.

ROWLAND, WILLIAM G. (Age 48) Asst. Prof., Texas A. & M. College, College Station, Tex.

SCISSON, SIDNEY EUGENE (Jun.) (Age 29) Engr., Pate Eng. Co., Tulsa, Okla.

SEDGWICK, WILLIAM DUNN (Age 45) Senior Engr., California Div. of Highways, Eureka, Calif.

SEWELL, OSCAR FLYNN (Age 50) County Engr., Pawnee Co., Pawnee, Okla.

SHARMA, BAIJ NATH (Age 35) Constr. Engr., Devahuwa Scheme, Nalanda, Natale, Ceylon.

SMALL, FRANK AUGUSTUS, JR. (Age 52) Res. Constr. Engr., Montana Highway Comm., Bozeman, Mont.

SMARIGA, JULIAN EMIL (Age 30) Design Engr., Bureau of Yards & Docks, Navy Dept., Washington, D.C.

SMITH, ROLLA GLENN (Age 46) Senior Engr., Burns & McDonnell Eng. Co., Kansas City, Mo.

SULLIVAN, JOSEPH NORMAN (Age 40) Engr., Ellerbe & Co., St. Paul, Minn.

SWITZER, ALFRED IVAN (Jun.) (Age 35) Engr. P-4, Asst. Chf., Civ. Works Branch, U.S. Engr. Office, Los Angeles, Calif.

TAYLOR, THOMAS MILTON (Age 40) Senior Structural Engr., Black & Veatch, Cons. Engrs., Kansas City, Mo.

THOMPSON, JOSEPHINE GLADYS (Jun.) (Age 28) Instructor, Coll. of City of N.Y., New York City.

VILLEMONTE, JAMES RICHARD (Jun.) (Age 34) Res. Asst. in Hydr. Eng., Univ. of Wisconsin, Madison, Wis.

WALKER, RAY LESTER (Jun.) (Age 33) with Huber & Knapik, Cons. Civ. Engrs., San Francisco, Calif.

APPLYING FOR JUNIOR

WALLACE, WALES WELLINGTON (Age 29) Res. Engr., Polk, Powell & Hendon, Engrs., (Birmingham, Ala.) at Nashville, Tenn.

DEVINE, JOSEPH RICHARD (Age 27) Engr. P-1, Bureau of Reclamation, Dillon, Mont.

EROL, DEMIRHAN (Age 24) With TVA, Knoxville, Tenn.

GEARY, WILLIAM JAMES (Age 25) Contr.'s Engr., John F. Casey Co., Constrs., Pittsburgh, Pa.; address Elkins, W.Va.

HALE, ISOM HOYT (Age 26) Hydr. Engr. P-2, U.S. Engrs., Ft. Worth, Tex.

KELLY, ROLAND PAUL (Age 26) With the Chester Engrs., Pittsburgh, Pa.

KULOW, WAYNE FREDERICK (Age 26) Structural Engr., Deere & Co., Moline, Ill.

MENEZES, PAULO CUNHA (Age 26) Civ. Engr., Moran, Proctor, Freeman & Mueser, Cons. Engrs., New York City.

REED, RICHARD LAW (Age 27) Asst. Engr., Worden-Allen Co., Milwaukee, Wis.

TENG, CHI-YU (Age 26) Research Asst., Univ. of Illinois, Urbana, Ill.

CLEMSON A. & M. COLL.

	AGE
HEDDEN, JOHN PAUL, 1946	(23)
LEVER, JACK QUINTON, 1942	(25)

UNIV. OF COLO.

KASENGA, JAMES WILBUR, 1944	(23)

GEORGE WASHINGTON UNIV.

MIKLOFSKY, HAAREN ALBERT, 1946	(26)

MASS. INST. TECH.

GHOSN, RAYMOND SALIM, 1946	(25)
PETERSON, ROBERT JAMES, 1944	(24)
SIEGL, STEPHEN JOSEPH, JR., 1946	(22)

MICH. STATE COLL.

FUGERE, DONALD EDWARD, 1942	(29)

UNIV. OF MO.

KRAUS, SAMUEL CHARLES, JR., 1946	(24)

NEWARK COLL. OF ENG.

FRUCHET, PIERRE AIMÉ, 1944	(23)

PRINCETON UNIV.

CHAMBERS, CARLETON ALFRED, 1946	(33)

UNIV. OF S.C.

MCMILLAN, CLAUDE RICHELIEU, 1946	(21)

SO. METHODIST UNIV.

WHITE, ARDIS HOWARD, 1943	(2[illegible])

UNION COLL.

AKINS, LEE OAKLEY, 1945	(2[illegible])

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

RECENT BOOKS

New books donated by the publishers and filed in the Engineering Societies Library, or in the Society's Reading Room. Notes regarding books are taken from the books themselves, edited by the staff of the Society or of the Library. Books in the Library may be borrowed by mail by Society members for a small handling charge.

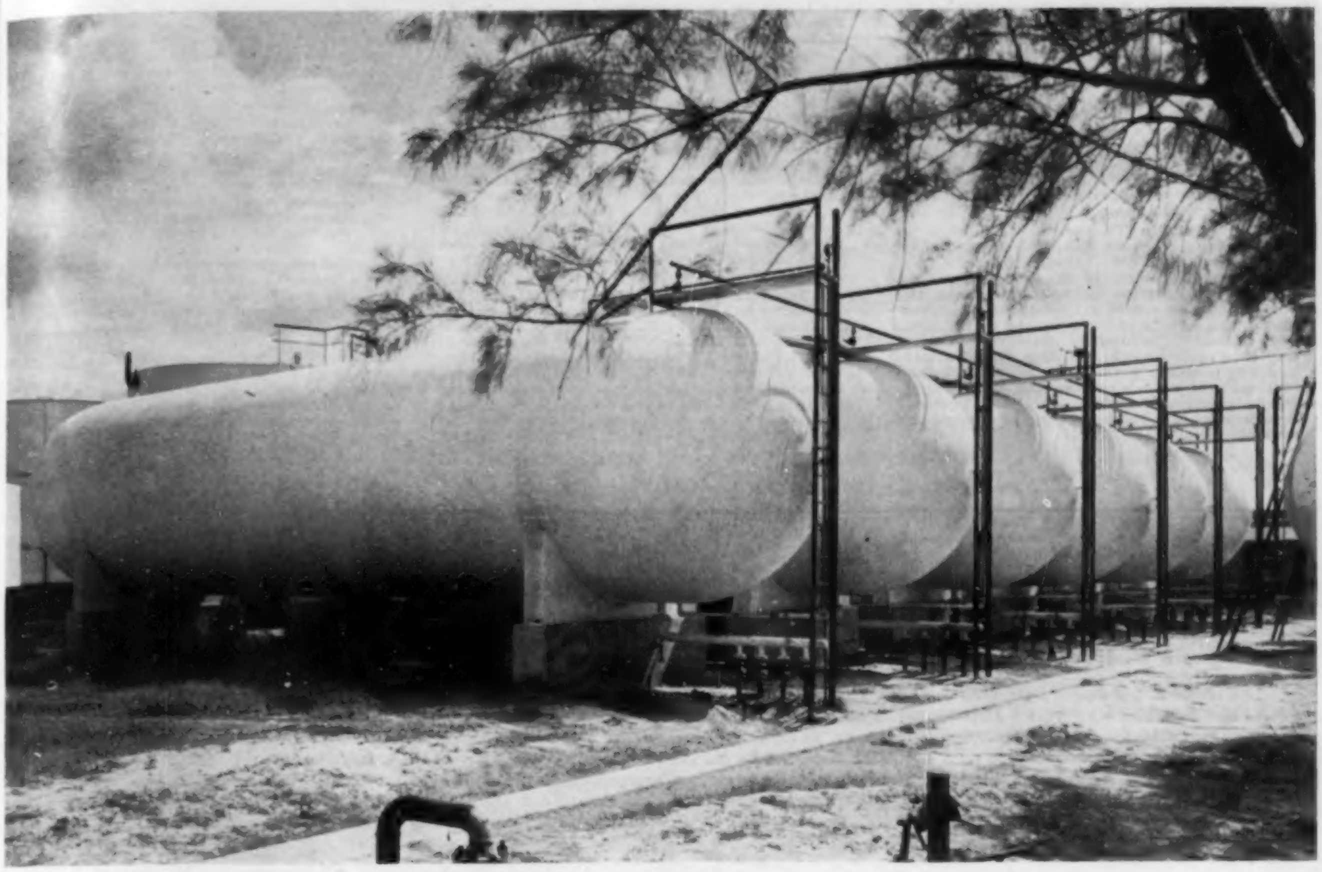
AERODYNAMICS. By A. W. Sherwood. McGraw-Hill Book Co., New York and London, 1946. 220 pp., illus., diagrs., charts, tables, $9^1/_4 \times 6$ in., cloth, $2.75. The more practical aspects of both theory and experiment in the field of aerodynamics are covered. Unusual emphasis has been placed upon the physical side of the theory in order to provide a general background for more intensive mathematical work. This permits the introduction of advanced topics such as compressibility and flutter. Experimental methods are discussed at considerable length because of the importance of model tests, and a description of the more important wind-tunnel corrections is included. There is a brief final chapter on "unconventional aircraft," covering the helicopter, jet propulsion, etc.

AIRPORTS: DESIGN, CONSTRUCTION AND MANAGEMENT. By H. K. Glidden, H. F. Law, and J. E. Cowles. McGraw-Hill Book Co., New York and London, 1946. 583 pp., illus., diagrs., charts, tables, $9^1/_4 \times 6$ in., cloth, $7. The first part of this comprehensive work outlines the requirements and factors entering into the problem of site selection and runway layout. This is followed by a condensed version of the field and laboratory tests and procedure for grading, drainage, and pavement design. Turfing, lighting, radio aids, traffic control, communications, and the basic principles of management are covered. Special features of the book include a discussion of the role of the government in the design and construction of civil airports; a chapter on obstructions, their lighting and removal; and a 300-page appendix containing full and exact specifications and test procedures for materials and construction methods.

APPLIED ELASTICITY. By J. Prescott. Dover Publications, New York, 1946. 666 pp., diagrs., charts, tables, $8^3/_4 \times 5^1/_2$ in., cloth, $3.95. Written from the viewpoint of the engineer rather than the mathematician, the mathematical theory is carried out only so far as is necessary for its application to practical problems. General stress-strain relations are first dealt with, followed by a number of chapters on thin rods, thin plates, and cylinders under various conditions of pressure and strain. Separate chapters are devoted to the vibrations of rotating disks and to elastic bodies in contact.

A.S.T.M. STANDARDS ON CEMENT (with Related Information), prepared by A.S.T.M. Committee C-1 on Cement; Specifications, Chemical Analysis, Physical Tests. American Society for Testing Materials, Philadelphia 3 (1916 Race St.), 1946. 185 pp., illus., diagrs., tables, 9×6 in., paper, $2. Included in this compilation are specifications for portland, blast-furnace, natural, masonry, and air-entraining cements, together with some 15 standard methods of chemical analysis and physical testing. Supplementary information on analytical balances and weights and cement testing in general is appended. There is also a list of selected references and an article on the principle of the methoxyl method for determining vinsol resin in portland cement.

GROUND WATER IN THE BALTIMORE INDUSTRIAL AREA. Prepared by J. C. Geyer. Published by the Maryland State Planning Commission, Baltimore (Johns Hopkins University), May 1945. 299 pp., illus., diagrs., charts, tables, 11×8 in., cloth, $1. The five sections of this comprehensive report cover, respectively, an introductory statement of the situation with regard to past work, present difficulties, and future studies; a brief general treatment of geology and hydrology; well records and studies in the area; a special discussion of chloride contamination; and a detailed description of the use of cement in well construction, repair, and sealing.



HIGHWAY RESEARCH BOARD. Proceedings of the Twenty-Fifth Annual Meeting. Edited by Roy W. Crum and Fred Burggraf. Published by the Highway Research Board, Washington, D.C., 1946. 486 pp., illus., tables, diagrs., charts, $9\frac{1}{2} \times 6\frac{1}{2}$ in., cloth. The Proceedings of the twenty-fifth annual meeting of the Highway Research Board of the National Research Council—held in Oklahoma City, January 25–28, 1946—constitute this volume. The subjects treated include economics, finance, and administration; design; materials and construction; maintenance; traffic and operations; soils investigations; and special projects.

IMPROVING LONDON'S TRANSPORT. Published by *The Railway Gazette*, Westminster, London, S.W.1 (33 Tothill St.), 1946. 108 pp., illus., diagrs., maps, tables, 12×9 in., paper, 5s. Covering both surface and subsurface lines, this publication opens with a brief historical discussion and an account of the scope and extent of the present works. Succeeding chapters cover subway construction work, including special details, signaling practice, stations and buildings, escalators and lighting, new rolling stock, power supply and distribution, and traffic operation. The book is well illustrated by photographs, diagrams, and maps.

(AN) INDEX OF MATHEMATICAL TABLES. By A. Fletcher, J. C. P. Miller, and L. Rosenhead. McGraw-Hill Book Co., New York; Scientific Computing Service Limited, London, W.C.1 (23 Bedford Square), 1946. 450 pp., diagrs., tables, $9\frac{1}{2} \times 6$ in., cloth, \$16. This valuable compilation provides a complete index to all published and some unpublished mathematical tables both in books and in magazines. Part I consists of 24 sections, each devoted to tables of a particular group of functions—logarithms, natural functions, exponential functions, Bessel functions, etc. The tables are generally listed in decreasing order of the number of decimals. Part II contains a listing of the references to tables arranged alphabetically by authors and chronologically under each author.

ROCK TUNNELING WITH STEEL SUPPORTS. By R. V. Proctor and T. L. White, with an Introduction to Tunnel Geology by K. Terzaghi. Commercial Shearing & Stamping Co., Youngstown (Ohio), 1946. 271 pp., illus., diagrs., charts, tables, $11\frac{1}{4} \times 7\frac{1}{2}$ in., cloth, \$2.50. Section I presents the geological information required for estimating the rock pressure on tunnel supports. Section II is devoted to the relationship between rock behavior, type of steel support, and the method of excavation, covering selection and general design of supports. Analytical methods of design of the supporting structure under assumed loading conditions are discussed in Section III. A catalog of the supports manufactured by the company issuing the volume is included as Section IV.

TERMINAL AIRPORT FINANCING AND MANAGEMENT. By L. L. Bollinger, A. Passen, and R. E. McElfresh. Harvard University, Graduate School of Business Administration, Boston, 1946. 385 pp., charts, tables, $8\frac{1}{2} \times 5\frac{1}{4}$ in., cloth, \$4.25. Based on an intensive field study of 51 airports and numerous conferences with executives and officials, this book presents the results in four parts: Part I considers public and private financial responsibilities, and develops a proposal for a rate-setting procedure to be used in assessing fair charges against airport users; Part II presents a financial analysis of airport operations, based on the actual figures obtained from the airports studied; Part III tests the practicability of the proposed rate-setting formula against the actual operating results reported in Part II; and Part IV is concerned with management, and after a brief discussion of essential airport records, emphasizes the questions of organization, incentives, and controls.

Engineering Societies Personnel Service, Inc.

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A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription of \$3 per quarter or \$10 per annum, payable in advance.

MEN AVAILABLE

CIVIL ENGINEER; Assoc. M. ASCE; age 36; registered, Texas; 7 years in Texas Highway Department; 4 years on Latin-American highways and runways. Desire Latin-American assignment of extended duration, on which family can accompany one, or sales connection involving materials or equipment of pavement construction. Some traveling not objectionable. Minimum salary, \$6,000, plus traveling expenses. C-333.

STRUCTURAL DESIGNER; Jun. ASCE; 27; married with 2 children; B.S. and M.S. in C.E.; licensed civil engineer; 2 years' college teaching; 3 years as a structural designer on all types of buildings and structures and most materials; 1 year of general construction experience. Desires position with permanent prospects in Western states. Housing desirable. C-335.

CIVIL ENGINEER; Assoc. M. ASCE; 37; registered professional engineer; 14 years' experience, principally in irrigation. Experience covers field of water supply, drainage, and conservation, and includes 2 years in Central America and 2 years in Europe. Fair knowledge of Spanish. Location not important. C-336.

CIVIL ENGINEER; Jun. ASCE; B.S. in C.E.; age 30; married; one year of experience on highway work; 7 years' experience in materials testing and inspection on construction projects. Testing soils, concrete, steel for highways, airfields, buildings; $2\frac{1}{4}$ years as assistant civil engineer for CAA in Anchorage, Alaska. Will accept position anywhere in the States; willing to travel some. C-337.

CIVIL ENGINEER; Jun. ASCE; 28; married; B.S. in C.E., University of Tennessee; 6 years' experience in surveying and mapping. At present engaged in topographic mapping for government agency. Looking for greater opportunity and outlet for ability. Desires position with construction firm in South. C-338.

SANITARY ENGINEER; Jun. ASCE; 31; married; 9 years' field and office experience in water supply, sewage, and highways. Desire permanent position with opportunity for advancement. Available on reasonable notice. C-339.

CIVIL ENGINEER; M. ASCE; 44; B.S. in C.E.; registered, New York, North Carolina, Virginia, Maryland, and Nebraska; holds certificate of qualification for registration in other states; 22 years' experience in municipal and subdivisions, water supply, sewers, streets and highways, reservoirs, dams, water power, housing, and public works planning. Desires permanent position. Available immediately. C-340.

CONSTRUCTION SUPERINTENDENT; Jun. ASCE; age 33; B.S. in C.E.; for small and medium-sized heavy construction projects. Specializing on waterfront construction (timber concrete, and steel). Veteran of Seabees. C-341

ASSOCIATE ENGINEER, 30–40, preferably licensed, some municipal and power plant experience desirable, for consulting engineer, Location Pennsylvania. W8164.

POSITIONS AVAILABLE

ENGINEERS capable of designing reinforced concrete or structural steel. Will do understudy work and begin by drafting. Location, North Carolina. W-6830. Reopened.

DESIGN ENGINEER, graduate, preferably mechanical. Must be familiar with structural steel members and hardware parts associated with electrical distribution and transmission lines. Write stating experience, etc., and attach picture. Salary open. Location, Maryland. W-8105.

STRUCTURAL DESIGNER, 40–50, with at least 15 years' experience with consulting architectural or engineering firm, to take responsible charge of commercial and institutional building projects supervision. Salary, \$6,000–\$8,000 a year. Location, New York, N.Y. W-8159.

CIVIL ENGINEER, graduate, 30–35, with administrative ability and experience in hydraulics, low-head pumps, and general construction experience. Some railroad construction and maintenance experience desirable. Salary, \$4,800–\$5,400 a year. Location, Florida. W-8166.

ENGINEERS for American mission. (*a*) Civil Engineer to head up construction of railroads and highways. Salary, \$9,000–\$10,000 a year. (*b*) Assistant to above. Salary, \$7,000 a year. (*c*) Consultant experienced in sewage and water systems. Salary, \$9,000–\$10,000 a year. Living quarters furnished for these positions. Location, Liberia. W-8207.

STRUCTURAL ENGINEER thoroughly experienced in design of locks and dams and with experience in mechanical design of hydraulically operated equipment, to handle design on a number of locks and dams for control of tidal waters. Location, Florida. W-8211.

CIVIL ENGINEER, graduate, with 5 to 10 years' experience, including sanitary engineering design or plant operation, to review plans and specifications for new construction on state institutions. Salary, to \$4,848 a year. Location, Virginia. W-8223.

ENGINEERS experienced in structural and architectural design and drafting. Work consists of designing and preparing drawings for power stations, industrial buildings, heavy foundations for electrical equipment, and transmission line structures. Location, upstate New York. W-8205.


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Current Periodical Literature

Abstracts of articles on civil engineering subjects from publications (except those of the American Society of Civil Engineers) in this country and foreign lands. The articles indexed are on file in the Engineering Society Library, 29 West 39th Street, New York, N.Y. Photoprints will be supplied by this Library at the cost of reproduction, 25 cents per page to members of the Founder Societies (30 cents to all others) plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

BASCULE. Skew Bascule Bridge Over Gowanus Canal, Brooklyn, N.Y. *Engineering*, vol. 161, no. 4200, July 12, 1946, pp. 25–27, figs. on p. 36. Illustrated description of bridge built during war to carry Hamilton Ave. over Gowanus Canal; choice made of "knee-girder" design worked out by Clinton D. Hanover. Apart from advantages of this type of bridge, its adoption showed saving of more than $300,000 over next most favorable design. It consists of two single-leaf bascules, each carrying single roadway for traffic in one direction.

CONCRETE ARCH, INDIA. Construction of Coronation Bridge of Tista River, North Bengal, India, C. G. Sexton. *Instn. Civ. Engrs.—J.*, vol. 26, no. 7, May 1946, pp. 384–396, 2 supp. plates; see also abstract in *Surveyor*, vol. 105, no. 2836, May 31, 1946, pp. 425–426. Work described from contractor's point of view. Main arch has span of 276 ft. Cantilever construction was adopted but it was practicable to use this method up to certain point only, leaving central gap of 120 ft, which was closed by steel-framed Melan arch springing from seatings at ends of cantilevers.

CONCRETE GIRDER. Reinforced Concrete Road Bridge, W. S. Wilson. *Surveyor*, vol. 105, no. 2849, Aug. 30, 1946, pp. 673–676. Illustrated description, stress analysis and design details of reinforced concrete girder road bridge of 50-ft span; decking is composed of precast concrete beams and precast concrete segments resting on latter; schematic drawing and load calculations.

CONSTRUCTION, MILITARY ENGINEERING. Cologne Road Bridge. *Engineer*, vol. 181, no. 4719, June 21, 1946, p. 565. Brief description of Patton Bridge, second of semi-permanent "ice-proof" bridges completed in British zone of occupation, designed to carry 12-ton vehicles and trailers at nose-to-tail spacing, or 40-ton military traffic at 80-ft spacing; 240-ft central span, built from German SKR bridging, weighs 450 tons; span was rested on 50-ft high Bailey superstructure, which in turn rested on raft. At least two months of building time was saved by separate construction of central span.

MAINTENANCE AND REPAIR, ARIZONA. Railroad Bridge Redecked for Vehicles, J. W. Green. *Eng. News-Rec.*, vol. 137, no. 2, July 11, 1946, pp. 53–54. Conversion to use by auto traffic, of single-track Red Rock Bridge crossing Colorado River at Topock, Ariz., was achieved by adding subfloor beams and maximum 7-in.-thick reinforced-concrete roadway slab. Job also included installation of steel protective railings and removal of structural reinforcing unnecessary for highway loadings.

MILITARY. Steel for One More River, P. Queneau. *Min. & Met.*, vol. 27, no. 475, July 1946, pp. 398–399. Notes on manufacture and use of so-called "meter beams," under direction of E. C. Itschner of U.S. Army Engineers. Rehabilitation of Hadir Steel Works at Differdange in Luxembourg. "Meter beams" are 40 in. deep, have wide flange, are 100 ft long, and weigh ten tons; such girders make ideal main members for hurriedly constructed river spans. Steel produced at Hadir was used to build hundreds of mixed bridges across rivers in Belgium and Germany.

MILITARY. War's Outstanding Floating Bridge. *Eng. News-Rec.*, vol. 137, no. 8, Aug. 22, 1946, pp. 226–227. Illustrated description of floating bridge built by American construction forces across Irrawaddy River in Burma as part of Ledo Road project; bridge is combination of floating spans, fixed-deck spans, and ferry slip design; structure accommodates 40-ft variation in river stage, and section of bridge may be removed to accommodate river traffic; data on structure and construction job.

PLATE GIRDER. Construction Bridge at Garrison Dam Designed for Maximum Salvage. *Eng. News-Rec.*, vol. 137, no. 4, July 25, 1946, pp. 109–112. Illustrated description of highway and railway construction bridge across Missouri River

on site of dam near Bismark, N.D. Designed for maximum salvage upon removal, bridge has all-steel, field-bolted superstructure, and special piers supported on long tubular steel piles.

RAILROADS, MAINTENANCE AND REPAIR. Replaces Bridge Across Sandusky Bay. *Ry. Age*, vol. 121, no. 5, Aug. 3, 1946, pp. 167–171. After maintaining timber trestles under difficulty for many years, New York Central has constructed permanent installation, doing work under heavy traffic conditions; construction details.

STEEL ARCH, FRANCE. Neuilly Bridge, Paris. *Engineer*, vol. 181, no. 4720, June 28, 1946, p. 584. Brief illustrated description of structure claimed to include longest welded steel arch so far erected in world. New bridge consists of two steel arches, each spanning arm of River Seine, connected by concrete arch on island.

STEEL, DEMOLITION. Razing Construction Bridge, R. G. Skerrett. *Compressed Air Mag.*, vol. 51, no. 7, July 1946, pp. 181–183. Illustrated views of operations, and dismantling procedures employed in removing steel superstructure and piers of bridge across Columbia River, used as supply line in construction of Grand Coulee Dam.

STEEL, FAILURE. Investigation of Failures in Welded Bridge, H. Busch and W. Reuleke. *Welding J.*, vol. 25, no. 8, Aug. 1946, pp. 463s–466s. Report on investigations into failure of three welded bridges in Belgium giving following main reasons for accidents: multiaxial state of restraint produced by welding stresses and enhanced by unfavorable distribution of welds; low ambient temperature; low notch impact characteristics of steel. English translation of paper from *Stahl u Eisen*, 62 (4), 66 (Jan. 23, 1944).

STEEL TRUSS, MAINTENANCE AND REPAIR. Reconstruction of Fire-Damaged Bridge Over Ottawa River. *Roads & Bridges*, vol. 84, no. 8, Aug. 1946, pp. 45–49, 118. Illustrated description of rehabilitation of combined highway-railway bridge over Ottawa River between Ottawa, Ont., and Hull, Que., damaged by fire in adjacent stock-pile of pulpwood. Structure has over-all length of 1,886 ft; damage affected 780 lin ft of bridge. Data on repair procedure, floor-beam splices, removal of track stringers and floor beams, and temporary walkway.

STEEL, WIND EFFECT. La acción del viento sobre los puentes metalicos, J. Negri. *Ciencia y Tecnica*, vol. 106, no. 528, June 1946, pp. 428–429. Action of wind on metallic bridges. Referring to modern practice as to adoption of permissible tensions for choosing dimensions of each pair of bridge structures, particularly bracing against wind, author reviews present dispositions for calculating stresses due to wind action on metallic bridges; location of wind braces on bridges with principal beams of Gerber type.

SUSPENSION, GREAT BRITAIN. Severn Road Bridge. *Surveyor*, vol. 105, no. 2853, Sept. 27, 1946, pp. 753–754. Brief description of proposed highway bridge over River Severn between Beachley and Aust; with 3,000-ft span it will be largest suspension bridge in Europe. Provision for two roadways, each 22 ft wide, two cycle tracks, each 9 ft wide, and two footpaths, each 6 ft wide; total length (including approach roads) about 8 miles; costs estimated at £7,500,000.

SUSPENSION, VIBRATION. Golden Gate Bridge Vibration Studies. *Eng. News-Rec.*, vol. 137, no. 6, Aug. 8, 1946, pp. 184–185. Illustrated report on measurements of vibrations by means of vibration-recording instruments; purpose of studies is to check theories and formulas dealing with wind-induced motion of suspension bridges.

WOODEN, MAINTENANCE AND REPAIR. Renew Big Logs in High Trestle. *Ry. Eng. & Maintenance*, vol. 42, no. 7, July 1946, pp. 731–733; see also *Ry. Age*, vol. 121, no. 3, July 20, 1946, pp. 86–89. High timber trestle, on which Cowlitz, Chehalis and Cascade crosses canyon of Cowlitz River in Washington, reaches height of 210 ft above stream bed and consists of 29 bents; 8 are 80 ft high and are carried across river on 10 big horizontal logs which are supported on A-frames, also constructed of logs, tops of which are at elevation of 130 ft above bed of river. Article explains how logs were placed under traffic.

BUILDINGS

CONCRETE. Design for Reinforced Concrete Buildings on Continuous Frame Principles, G. S. Boris. *Commonwealth Engr.*, vol. 34, no. 1, Aug. 1, 1946, pp. 6–11. Abbreviated moment distribution method, with illustration of actual mechanical procedure of design of reinforced concrete building frame, applying this method for finding maximum design moments.

CONSTRUCTION. Floors Away! M. Huden. *Constructor*, vol. 28, no. 8, Aug. 1946, pp. 35–36. Description of lowering three entire floors of hotel in Cincinnati, Ohio, which is to be converted into part of new department store building; lowering to same level as present store is accomplished by use of more than 100 jacks, which are operated simultaneously by crew of workmen, thus lowering floor about 16 to 24 in. per day; stages of construction presented.

HOUSES, PREFABRICATED. Concrete Floors and Roof Units for Housing, W. S. Wilson. *Surveyor*, vol. 105, no. 2850, Sept. 6, 1946, pp. 695–696. Application of precast concrete channel units to floors and roofs of permanent housing schemes is presented; stress analysis for typical loading shown.

HOUSES, PREFABRICATED. Concrete Houses—Current Construction Practice. *Concrete*, vol. 54, no. 9, Sept. 1946, pp. 31–34, 37. Illustrated description of vacuum mats and their application to precast concrete house panels; procedure permits handling of panels within hours instead of days. Data on one- and two-story concrete houses and on costs of double houses.

CITY AND REGIONAL PLANNING

BOMBING DEFENSE. Planning Cities for Atomic Age, T. B. Augur. *Am. City*, vol. 61, no. 8, Aug. 1946, pp. 75–76 and 123. Discussion of protective measures against danger from atom bombs, by means of two different methods of arranging urban area of city; one of them presents usual concentrated development with open country beyond, the other is combination of urban and rural advantages by increasing distances between parts of city and surrounding them by open country. Before Am. Inst. Planners, New York City.

MANILA, P.I. Rebuilding Manila, H. Leopold. *Eng. News-Rec.*, vol. 137, no. 6, Aug. 8, 1946, pp. 172–177. Illustrated report on reconstruction of war-damaged city and port of Manila; data on renascence at port, repair of pier breaches, timber extensions to piers, highways and bridges; post-war plans are to move most industry out of down-town area, and turn it into region of broad boulevards, squares, and bridges; present water supply will be expanded.

CONCRETE

AIR ENTRAINMENT. Interground Air-Entrained Concrete. *Concrete*, vol. 54, no. 9, Sept. 1946, pp. 28–30. Unusually uniform results in appearance, workability and compressive strength have been achieved by means of air-entraining concrete on two reinforced-concrete structures in Midwest. Illustrated report on construction of Sears Roebuck store and U.S. Naval Ammunition Depot.

AIRPORT RUNWAYS. Designing and Building Concrete Apron at Duluth Airport, A. W. Tewes. *Pub. Works*, vol. 77, no. 9, Sept. 1946, pp. 22–23, 45. Data on additions to existing runways; stress determination by means of Westergaard's analysis. Bearing value of apron is sufficient for 80,000-lb wheel load for 16 planes per day with tire pressure of 85 psi.

AIRPORTS, WASHINGTON, D.C. Novel Taxiway Improvements at Washington National Airport

Allow Speeding Up of Ground Traffic. *Roads & Streets*, vol. 89, no. 7, July 1946, pp. 86–90. Concrete paving project on widely different types of subgrade material at Washington National Airport presented difficulties in design and construction which are overcome by bearing tests, pipe drains, and proper construction equipment; illustrated description of tests and construction.

CAISSONS. Reinforced Concrete Caissons for Marine Works, S. C. Bailey. *Dock & Harbour Authority*, vol. 27, nos. 308, 309, June 1946, pp. 45–49, July, pp. 71–73. Shape of caissons; thickness of walls and bottom; concrete proportions and strength; steel work; construction of caissons; launching of caissons from slipways; towing; buoyancy, center of gravity and ballasting caisson for wharf wall, breakwater, training wall and for dolphin mooring; types of caissons; diagrams given.

CREEP. Effects of Creep on Instability and Indeterminacy Investigated by Plastic Models, A. D. Ross. *Structural Engr.*, vol. 24, no. 8, Aug. 1946, pp. 413–428. Brief review of effects of creep in reinforced concrete structures; study of behavior of statically indeterminate structures under influence of creep; results of theory confirmed by experiments with continuous beams and two-pinned arches; effects of creep in mechanical analysis of structures by means of plastic models. Bibliography.

FOOTBRIDGES. Reinforced Concrete Cantilever Footbridge, S. B. Wilson. *Survey*, vol. 105, no. 2847, Aug. 16, 1946, pp. 639–641. Illustrated description of footbridge to carry pedestrian traffic across 80-ft opening; main structure consists of two cantilever beams, projecting 25 ft and 15 ft, respectively; equilibrium of cantilever arms is maintained by two mass concrete counterweights at each end of bridge; stress analysis and details of structure.

MIXING. Install Moisture Determination System at Florida Block Plant, W. M. Avery. *Pit & Quarry*, vol. 39, no. 2, Aug. 1946, pp. 131–132, 134. Illustrated description of scientific concrete precision control for batching as applied at Tampa, Fla; $(SC)^2$ system provides quick and accurate means of compensating for moisture present in materials, making it possible to produce batch after batch of concrete in which variation in water content will not exceed $1/4$ of 1% or 1 gal per cu yd.

RESERVOIRS. Precast Sectional Wells and Roof Allow for Uneven Reservoir Settlement. *Eng. News-Rec.*, vol. 137, no. 8, Aug. 22, 1946, pp. 244–248. Concrete storage basin for 7,000,000-gal clear water in New Orleans, La., has relatively thin pre-cast concrete slabs in both walls and roof; former are surrounded by earth-fill cofferdam that seals leakage and furnishes some resistance to hydrostatic pressure; this unusual structure is expected to reduce cracking of reservoir on unstable soil; reservoir measures approximately 309 by 383 ft inside vertical walls; interior clear height is about 14 ft.

ROADS AND STREETS, CALIFORNIA. Fastest Concrete Paving Jobs Also Best Quality, E. Withycombe. *Calif. Highways & Pub. Works*, vol. 24, nos. 3–4, Mar.-Apr. 1946, pp. 9–13; see also *Roads & Streets*, vol. 89, no. 7, July 1946, pp. 107–108. Information gained from study of California pavements led Materials and Research Dept. to radical departure from conventional design of concrete pavements. Expansion joints will be eliminated except at bridge end. Data on other pavement types such as asphalt concrete and bituminous treated surfaces.

STRESSES, REVIEW. Some Developments in Design Theories. *Concrete and Constr. Eng.*, vol. 41, no. 7, July 1946, pp. 181–183. Review of recent developments of plastic theory of reinforced concrete in Russia, Brazil, Switzerland and Great Britain.

WALLS. Shooting Concrete Into Walls Cuts Lumber Use and Labor Costs. *Eng. News-Rec.*, vol. 137, no. 2, July 11, 1946, pp. 48–50. Construction details of building walls with gunite. Footing is poured with steel dowels extending upward; single wood form is then erected on outside surface of wall area and gunite is shot from inside at nozzle pressure of at least 30 psi, with water added within specially constructed nozzle. Walls so constructed have varied from 14 to 40 ft in height and from 5 to 8 in. in thickness.

CONCRETE ARCH, CALIFORNIA. First Ventura Flood Project, J. M. Fox. *Western Construction News*, vol. 21, no. 8, Aug. 1946, pp. 77–79. Brief illustrated report on construction of concrete-arch Matilija Dam on tributary of Ventura River, Calif., to control undependable water supply and flood peril; general data, outlet works, and construction features.

DAMS

CONCRETE, FRANCE. French Engineers Build Dam with Spillway Over Powerhouse. *Eng. News-Rec.*, vol. 137, no. 6, Aug. 8, 1946, pp. 182–183. Illustrated description of St. Etienne-Cantales Dam on Core River, France. A compromise between arch and gravity dam, it is notable for its spillway, which is carried over roof of powerhouse in such a manner as to form jet that dissipates energy of falling water harmlessly below dam.

CONCRETE, FRANCE. L'Aigle Dam, France. *Engineer*, vol. 181, nos. 4719, 4720: June 21, 1946, pp. 556–559; June 28, pp. 578–580. Description

dam, one of four planned or in existence across River Dordogne, forming part of project for controlling river as it flows through series of gorges. Combined gravity arch, or semi-arch, structure resists thrust of impounded water in part by arch action against walls of gorge and in part by its weight. Machinery hall is placed at toe of dam, with twin spillways discharging over hall roof. Vibrated concrete of plastic consistency and with large aggregate was used.

Concrete Gravity, Wyoming. Missouri Basin—Initial Project Begun at Kortes. *Western Construction News*, vol. 21, no. 9, Sept. 1946, pp. 92–94. Report on start of construction of Missouri River Basin development; Kortes Dam, 60 miles southwest of Casper, Wyo., is first step in basin-wide plan to create more than 100 new reservoirs and furnish 153,700,000 kwhr annually to Colorado-Wyoming-Nebraska power system. Kortes Dam is 240 ft high, concrete gravity type. Power plant containing three 12,000-kw generators will be of reinforced concrete.

Design. Preliminary Engineering Studies for Dam Design, S. R. Sapirie. *Agric. Eng.*, vol. 27, no. 9, Sept. 1946, pp. 415–422. Engineering studies required for intermediate size dam are described, assuming that site, type and size of structure required have been decided, and also assuming that special studies to determine water yield and potential reservoir silting have been completed satisfactorily. Illustrations and diagrams given. Before Am. Soc. Agric. Engrs.

Earth, Arizona. Davis Dam Scheduled for 1949 Completion. *Eng. News-Rec.*, vol. 137, no. 8, Aug. 22, 1946, pp. 230–233. Report on construction of Davis Dam on Colorado River, Ariz.; it is 3,900,000-cu yd earth-and-earth dam with central core of impervious material, layer of semi-pervious material on each side, and final layer of larger rock to provide required mass; data on dam, diversion, and forebay channel, outdoor-type power plant, sequence of operations, cost and capacity.

Earth, Australia. Eildon Reservoir. *Civ. Eng.* (London), vol. 41, no. 482, Aug. 1946, pp. 313–314. Brief description of proposed reservoir to be constructed on site of Eildon Dam on Goulburn River, Australia, to satisfy demand for irrigation water. Preliminary design provides for earth and rock-fill construction, with concrete spillway on left bank and provision of hydro-electric-power development on right bank. Dam having height above stream bed of 250 ft will be among highest earth-fill dams in world.

Earth, California. Outlet Tunnel Serves Multiple Purposes at Rector Creek Dam. *Western Construction News*, vol. 21, no. 7, July 1946, pp. 79–82. Data on earth-fill Rector Creek Dam on northern fringe of San Francisco Bay, Calif. Spillway and outlet tunnel carry both temporary water-supply line and creek diversion during construction, excavating, embankment and concreting. General layout, spillway cut and tunnel intake are presented in illustrations.

Earth, Colorado. Drouth Insurance—Greely Completes New Water System. *Western Construction News*, vol. 21, no. 7, July 1946, pp. 89–91. Earth and rock-fill dam on Cache La Poudre River has made city of Greeley, Colo., secure from standpoint of water supply. Effect of wide variations in river flow will be minimized by operation of storage reservoir. Data on Milton Seaman Dam, outlets, diversion of city supply, etc.

Foundations. Exploring Dam Foundations, R. T. Sill. *Western Construction News*, vol. 21, nos. 7 and 8, July 1946, pp. 95–99, and Aug., pp. 87–90. Discussion of earth formation, rock classification, penetration of water, and foundation examination; illustrated description of methods of foundation grouting for various types of material, treatment of fault zones and pervious materials in dam foundations; stopping of seepage; discussion of dangers of incomplete investigation and incorrect interpretation of findings; practical examples.

Intakes. Hydraulic Design of Conduit Intakes in Dams, B. O. McCoy. *Boston Soc. Civ. Engrs.—J.*, vol. 33, no. 3, July 1946, pp. 174–184. Study of proper shape at intake to avoid excessive turbulence and resulting head losses; chart presents loss in kwhr and dollar value for various head losses and flow. Elliptically shaped profile for sides of circular entrance of conduits through Grand Coulee Dam gave good results, according to Bureau of Reclamation. Investigations revealed that rectangular racks and gates are desirable, particularly for large conduits. Bibliography.

Reservoirs, Dredging. 50-Year Accumulation dredged From Sedimentation Basin, J. E. Gill. *Water Works Eng.*, vol. 99, no. 15, July 24, 1946, pp. 850–853. Description of method of cleaning out Queen Lane sedimentation basin in Philadelphia, Pa., by using deep-water, steel-hull dredge; basin had to be kept in continuous service with requirements that operation should not increase turbidity of water or interfere with operation of treatment plant; data on job and costs presented.

Reservoirs, Dredging. Tough Lake Dredging Job, N. Zeller. *Pac. Bldr. & Eng.*, vol. 52, no. 9, Sept. 1946, pp. 52–55. Roslyn Lake, Ore., is used as storage basin for hydroelectric plant of Portland General Electric Co. When storage capacity was reduced by half through accumula-

tion of estimated 840,000 cu yd of sand and silt, floating suction dredge was used; illustrated description of installation and operation.

RESERVOIRS, MASSACHUSETTS. World's Largest Water Supply Reservoir Fills. *Water Works Eng.*, vol. 99, no. 16, Aug. 7, 1946, pp. 914–915. Brief description of Quabbin reservoir of Massachusetts Metropolitan District Water Supply Commission, which was filled on May 30 to crest of masonry spillway of Winsor Dam; data on capacity (416 billion gal) and comparison with other large reservoirs; filling of Quabbin reservoir began in 1939; total drop from full reservoir to river is about 150 ft.

FLOOD CONTROL

DRAINAGE PUMPING PLANTS. Six of World's Largest Pumps Protect Cincinnati Against Floods. *Power*, vol. 90, no. 8, Aug. 1946, pp. 511–513. Description of facilities installed as control means during Ohio River floods. Vertical-shaft synchronous motors, rated 6,500 hp, 6,600 v and 180 rpm, drive axial-flow propeller, vertical-shaft pumps of 1 billion gpd capacity, equipped with 10-ft-dia impellers. Design and operation of plant and diagrams of layout.

FOUNDATIONS

BRIDGE PIERS. Deep-Water Piers Built "Open Hole" Without Seal, H. J. McKeever. *Roads & Streets*, vol. 89, no. 7, July 1946, pp. 67–71. Report on "open dry" pier construction for two highway bridges across Elk River and Honey Creek in northeastern Oklahoma. Each pier consists of two circular shafts pyramiding from 11-ft-dia footing to top steel sheeting was driven to rock at 50 ft and clamped "silo" fashion around circular cage to eliminate leakage. Technical details described.

FROST EFFECT. Research on Frost Action in Soils, R. M. Hardy. *Roads & Bridges*, vol. 84, no. 9, Sept. 1946, pp. 74–76, 102. Discussion of damages to highways by frost and procedure for building on "permafrost" foundations; explanation of freezing procedure in soils, with reference to research in Sweden and United States. Tests showed that coarse-grained materials provide reasonably good foundations. Site where ice segregation has occurred in permafrost should not be chosen; if inevitable, it is better not to remove natural surface insulation.

PIERS. Piers and Wharves on Steel Cylinders, E. H. Harlow. *Eng. News-Rec.*, vol. 137, no. 2, July 11, 1946, pp. 33–35. Illustrated description of steel cylinders used as bearing members for piers and wharves in deep water. Their greater rigidity for high unsupported lengths reduces lateral bracing. Tests have shown that shells are adequate load bearer so that clearing muck from shells and filling them with concrete can be eliminated. Example of pier at Algiers, La.

PILES. Long Steel Piles. *Construction Methods*, vol. 28, no. 8, Aug. 1946, pp. 96–98. Illustrated description of foundation, where piles as long as 120 ft are being driven for office building in Boston, Mass.; pile lengths that require splicing are welded in jigs that rotate pile to permit downhand welding.

RETAINING WALLS. Cantilever Retaining Walls, N. A. Matheson. *Dock & Harbour Authority*, vol. 27, no. 309, July 1946, pp. 63–64. Typical examples of cantilever walls, distinct merit of which is obviating need for walings, tie-rods and anchorages, thus avoiding disturbance of ground and buildings close to site. Design calculations.

HYDROELECTRIC POWER PLANTS

MAINTENANCE AND REPAIR. Fighting Wear on Hydro Works. *Elec. West*, vol. 96, no. 6, June 1946, pp. 101–103. Illustrated description of series of repairs to hydro facilities completed on Southern California Edison Co. system in southern Sierra Nevada Mountains. Ward Tunnel repair, Borel Canal, Kaweah Canal, backfilling dams, Kern River No. 3 tunnel.

IRRIGATION

HYDROLOGY, ARGENTINA. Regimen de la Alta Cuenca del Rio San Juan, D. A. Sardina. *Revista de la Administracin Nacional del Agua*, vol. 10, no. 108, June 1946, pp. 420–428. Regulation of upper valley of San Juan River. General outline of establishment of study of possible utilization, chiefly for irrigation purposes, of the most precipitous steam that flows into west central Argentina; snowfall measurement; natural storage reservoir; stream gaging. Accurate knowledge of snowfall permits prediction of torrential flow when thaw sets in. Regulation by installation of impounding dams.

LAND RECLAMATION AND DRAINAGE

CULVERTS, CORRUGATED METAL. Study of Bituminous-Coated Corrugated Sheet Metal Culverts, J. Y. Welborn and P. J. Serafin. *Pub. Roads*, vol. 24, no. 9, July-Aug.-Sept. 1946, pp. 227–238. Illustrated report on study made by Public Roads Admin. of culverts installed for drainage of surface water on Blue Ridge parkway. Data obtained indicate most severe deterioration at outlet ends of pipe; outside asphalt coating had very little adhesion to metal. Metal-reinforced asphalt-paved inverts showed greatest deterioration, while asbestos-bonded metal appeared to have greatest resistance.

Culverts, Design. Reducing Unknowns in Small-Culvert Design, F. T. Mavis. *Eng. News-Rec.*, vol. 137, no. 2, July 11, 1946, pp. 51–52. Development of rating chart to be used for determination of discharge through culvert. Schematic analysis of rainfall and runoff records shows how time of concentration for watershed and intensity of rainfall can be found easily. Numerical example illustrates use of rating scale.

Roads and Streets. Theory of Overland Flow and Its Application to Design of Drain Inlet Spacing on Roads, W. Eastwood. *Surveyor*, vol. 105, no. 2848, Aug. 23, 1946, pp. 651–653. Discussion of Horton's overland-flow formula and its application to calculation of best spacing for drain inlets on roads; shape of gutter; Manning's formula; charts showing actual and computed hydrographs, evaluation of maximum runoff, variation and intensity of rainfall, and permissible distance between drain inlets. Bibliography.

MATERIALS TESTING

Bridges, Concrete Slab. Studies of Slab and Beam Highway, Bridges—I, N. Newmark, C. P. Siess, and R. R. Penman. *Ill. Univ., Eng. Experiment Station, Bul. series no. 363*, Mar. 8, 1946, 132 pp. Report on laboratory tests on quarter-scale models of I-beam bridges to compare measured strains with theoretically computed values, and to determine ultimate capacity of bridges and their manner of failure. Report presents in detail description of bridges, materials, influence lines for strains in beam and in slab reinforcement and deflection; discussion of results. Tests of reinforced mortar described in appendix.

Soils. Nevada Highway Compaction Tests. *Roads & Streets*, vol. 89, no. 7, July 1946, pp. 72–73, 125. Illustrated report on simplified soil-testing apparatus used by Nevada State Highway Dept.; description of method of determining relative compaction of soil; table used for finding dry weight per cu ft; numerical example.

Soils. Soil Tests for Military Construction, G. E. Bertram. *Am. Road Bldrs.' Assn.—Tech. Bul. no. 107*, 1946, 95 pp. Description of laboratory soil testing and its application to airfields, roads and shallow building foundations; data on field identification of soils, equipment, sampling; suggestions for field bearing and traffic tests.

PORTS AND MARITIME STRUCTURES

Boston, Mass. Port of Boston. *Naut. Gaz.*, vol. 139, no. 7, July 1946, pp. 42–49. Commercial history; normal commodity movement; steamship lines; new Port of Boston Authority; Greater Boston Development Committee; Boston harbor; terminal facilities; brief description of Hoosac and Castle Island terminals; supplementary services; ship construction and repair facilities.

Philadelphia, Pa. Port of Philadelphia. *Naut. Gaz.*, vol. 139, no. 8, Aug. 1946, pp. 44–50. Brief historical review, channels, terminal facilities, Camden waterfront, ship construction and repair.

Seawalls. Flexible in Situ Sea Wall Construction. *Surveyor*, vol. 105, no. 2842, July 12, 1946, pp. 539–540. Illustrated description of construction of flexible concrete sea wall at Brightlingsea, England; flexibility was achieved by casting in situ small-sized bays dowelled together with steel bars being cast in one and insulated from each other by building paper.

Shore Protection. Along Waterfronts. *American City*, vol. 61, nos. 8 and 9, Aug. 1946, pp. 92–94, and Sept., pp. 125–127 and 161. Report on beach, shore-line, and harbor improvements planned by cities from coast to coast; examples taken from San Francisco, Los Angeles, San Diego, Detroit, Portland, Chicago, Baltimore, and Florida are described.

RAILROADS, STATIONS AND TERMINALS

Roofs. Station Dome Gets New Aluminum Cover. *Ry. Age*, vol. 120, no. 22, June 1, 1946, pp. 1109–1111; see also *Ry. Eng. & Maintenance*, vol. 42, no. 6, June 1946, pp. 630–632, 638; *Ry. Gaz.*, vol. 85, no. 3, July 19, 1946, pp. 72–73. Cincinnati Union Terminal replaces tile roof on half dome and barrel arch over main concourse with segmented aluminum alloy covering. After underlying surface had been prepared, prefabricated aluminum sheets were applied and secured with specially designed battens and caps. New surface, with interlocked sliding joints, permits free expansion and insures light, watertight, durable roof.

ROADS AND STREETS

Airports, Detroit. Detroit's Airport Plan. *Am. City*, vol. 61, no. 8, Aug. 1946, pp. 90–91. Discussion of recommended designs and locations selected for different types of airport to meet requirements for Detroit, Mich.; studies indicate that 37 airports of all classifications will be needed by 1960; date on layout of runways.

Airports, Planning. Design Requirements for Airports, W. E. Cullinan, Jr. *Roads & Bridges*, vol. 84, no. 7, July 1946, pp. 53–54, 78–85. Discussion of problems connected with airport design, such as site, number of runways, ground movement, taxiways, buildings and business facilities. Before American Road Builders' Assn.

Airports, Runway Construction. Tests of Flexible Pavement for Airport Runways. *Eng.*

News-Rec., vol. 137, nos. 2, 4: July 11, 1946, pp. 36–40; July 25, pp. 113–117. Report on investigation of flexible pavements of various kinds for runways to verify California bearing-ratio method for evaluating subgrades. Data on test mechanism, construction control tests, deflection and pressure devices. Deflection and pressure measurements obtained, and analysis followed in determining design curves are outlined.

CALIFORNIA. Fifth Avenue Overhead on East Shore Freeway Is Started, J. Plowe. *Calif. Highways & Pub. Works*, vol. 24, nos. 7–8, July-Aug., 1946, pp. 17, 31. Report on extension of East Shore Freeway through City of Oakland in Alameda County. On section from Oak Street to High Street there will be three large overhead structures across railroad tracks and streets; in addition, three structures will carry important city streets over freeway. Data on structure, design features, and construction procedure.

COLOMBIA. Road Construction in Colombia, R. C. Skinner. *Roads & Bridges*, vol. 84, no. 8, Aug. 1946, pp. 62–63, 83–92. Illustrated report on highways of Colombia; data on mileage, type of construction, adequacy of highway system in terms of economic needs, and national policy in regard to new road construction; data on transportation routes, highway development, expenditures, eastern, central, and transversal trunk highway, and Pan American Highway.

CONCRETE, NEW YORK. New York State Starts Building World's Finest Concrete Road. *Concrete*, vol. 54, no. 9, Sept. 1946, p. 13, 21. Brief report on construction of throughway that ultimately will extend from New Jersey border to Pennsylvania state line near Erie, Pa.; throughout entire 486 miles there are no intersections at grade. New highway will have all features of modern concrete pavements; completion expected within 5 years.

CONSTRUCTION, CALIFORNIA. New Redwood Highway Project, R. P. Duffy. *Calif. Highways & Pub. Works*, vol. 24, no. 7–8, July–Aug. 1946, pp. 14–15 and 28. Illustrated report on conversion of Redwood Highway in North California into four-lane limited-access freeway between Ignacio and Petaluma; construction of two reinforced concrete bridges is included in contract.

EXPRESSWAYS AND PARKWAYS, CALIFORNIA. Fifth Avenue Overhead on East Shore Freeway Is Started, J. Plowe. *Calif. Highways & Pub. Works*, vol. 24, no. 7–8, July-Aug. 1946, pp. 17 and 31. Report on extension of East Shore Freeway through city of Oakland in Alameda County; on section from Oak Street to High Street there will be three large overhead structures across railroad tracks and streets; in addition, three structures will carry important city streets over freeway; data on structure, design features, and construction procedure.

GERMANY. German Construction Methods, D. W. Winkelman. *Constructor*, vol. 28, no. 8, Aug. 1946, pp. 27–31. Report on airport and road construction in Germany, dealing with soil stabilization, autobahn, ground-water lowering and compaction of soils. Unusual construction methods and effect of bombing on structures presented.

HIGHWAY TRAFFIC SIGNS, SIGNALS, AND MARKINGS. Barricades and Warning Devices for Highway Construction Work. *Nat. Safety News*, vol. 53, no. 4, Apr. 1946, pp. 32–33. Industrial Data Sheet D-Con. 6, published by National Safety Council. Information includes acceptable procedures in design, installation and illumination of signs and barricades for prevention of accidents to public and to worker during highway construction or maintenance operations.

MAINTENANCE AND REPAIR. Cincinnati Protects Its Streets by Extensive Resurfacing and Sealing. *Eng. News-Rec.*, vol. 137, no. 10, Sept. 5, 1946, pp. 302–306. Cincinnati, Ohio, is engaging in large resurfacing program. Both hot-mix and cold-mix asphaltic concrete receives greatest attention, with surface treating following close second; sheet asphalt, recut granite block and paving brick are used extensively to maintain heavily traveled pavement in street railway area.

MAINTENANCE AND REPAIR. Mudjacking in Texas, M. B. Hodges. *Roads & Streets*, vol. 89, no. 8, Aug. 1946, pp. 86–90. Description of mudjacking method, equipment and procedure applied by Texas State Highway Dept. in restoration of more than 500 miles of concrete pavements. Critical observations on concrete pavement, its maintenance and design.

MAINTENANCE AND REPAIR. New York Rebuilds Outmoded Highway, H. K. Glidden. *Roads & Streets*, vol. 89, no. 8, Aug. 1946, pp. 67–70. Illustrated report on main engineering features of rebuilding outmoded sections of highway between Lockport and Medina, N.Y. Existing pavements, both concrete and macadam, are widened and shaped to serve as foundation course for new concrete pavement. Description of mechanized paving equipment to expedite job.

MAINTENANCE AND REPAIR. Salvaging Old Concrete Pavements, J. G. Schaub. *Roads & Bridges*, vol. 84, no. 8, Aug. 1946, pp. 57–61, 92–94, 96–97. Illustrated description of methods used by Michigan State Highway Dept.; discussion of mud-jacking, surface patching, surface treatment, road-mixed surfaces, plant-mixed recapping, recapping with concrete, and costs.

Maintenance and Repairs, Nashville, Tenn. Nashville Streets Get New Surface Treatment, W. A. Coolidge. *Am. City*, vol. 61, no. 9, Sept. 1946, pp. 101–102. To catch up on maintenance deferred during war, Nashville, Tenn., developed resurfacing program for streets whose base is sufficiently good: tack coat of asphalt is rolled about four times with 10-ton roller. Maintenance treatment of these streets is anticipated once every 5 years.

Maintenance and Repair, Seattle. Seattle Street Resurfacing. *Western Construction News*, vol. 21, no. 9, Sept. 1946, pp. 100–102. New asphalt mix used at Seattle, Wash., to resurface roads contains little dust and low asphalt content but forms tight and compact surface. Data on mix characteristics; street construction; raising of street structures such as manholes and drop inlets to conform to new grade.

Military Engineering, Iran. How Strategic Iran Desert Highway Was Built for Wartime Transport, M. C. Ritter. *Pit & Quarry*, vol. 39, no. 3, Sept. 1946, pp. 105–107. Construction was started in 1942 by private engineering company, but American Army Engineers came in the same year and continued job; after asphalt mat and seal coat of asphalt were laid, crushed rock topping was applied; latter was only way to maintain wearing surface; description of adverse conditions under which work had to be done, and of equipment used.

WATER TREATMENT

Chlorination. Automatic Chlorination of New York's Reservoir Effluents, A. Brown. *Water Works Eng.*, vol. 99, no. 11, May 29, 1946, pp. 620–623, 646, 648–649. Illustrated description of equipment installed for automatic chlorination of effluents from four open-water reservoirs of New York City; special problems required modified installations which are discussed; bacteriological results of sample analysis reveal effectiveness of installations.

Filtration Plants, Oklahoma City, Okla. Unit Construction of Filter Plant. *Eng. News-Rec.*, vol. 136, no. 18, May 2, 1946, pp. 715–718. Incorporating latest features of contemporary design, new filtration plant at Bluff Creek Reservoir near Oklahoma City, Okla., will furnish additional 15 mgd of filtered water; low-lift pumping arrangement accommodates 40-ft variation in lake level; there are safety signals for equipment operation and push-button control for water sampling.

Industrial. Control of Fouling Organisms in Fresh- and Salt-Water Circuits, J. G. Dobson. *Am. Soc. Mech. Engrs.—Trans.*, vol. 68, no. 3, Apr. 1946, pp. 247–260, (discussion) 260–265. Difficulties encountered by industrial water users due to fouling organisms; to control fouling, knowledge of organism's life cycle and reactions to stimulus is necessary; mollusks, Bryozoa, sponges, barnacles, and tunicates are considered; it is concluded that chlorination is most effective and economical method. Bibliography.

Mining Camps. Good Town Water Supplied by New Princess-Elkhorn Plant. *Coal Age*, vol. 51, no. 6, June 1946, pp. 88–89. Soft, potable water for town of David, Ky., assured by installation of new-type treating equipment; supply obtained from deep well, hauling from outside eliminated, and cost cut substantially.

WATER WORKS ENGINEERING

Maintenance and Repair. Method of Reconditioning Elevated Water Tanks, W. E. Huddleton. *Oil Weekly*, vol. 122, no. 7, July 15, 1946, p. 54. Description of procedure worked out by large gas utility organization, for 50,000-gal tanks used to store engine jacket water at main line compressor stations; program includes installation of cathodic protection.

Maintenance and Repair. Multi-Purpose Seal Coat Protects Waterworks Structures, P. Weir. *Eng. News-Rec.*, vol. 136, no. 18, May 2, 1946, pp. 728–731. Investigation of filter plants at Atlanta, Ga., led to use of compound which served both as rustproofing and waterproofing; material was used in restoring steel tanks and concrete units, and rustproofing cast-iron valves and fittings; illustrated description of procedure and equipment used; data and man-hours required.

St. Louis, Mo. Planned Improvements for St. Louis, T. J. Skinker and E. E. Easterday. *Am. Water Works Assn.—J.*, vol. 38, no. 7, July 1946, pp. 826–837. Illustrated description of plan for modernization of water works at St. Louis, Mo.; data on present water supply system, proposed improvements, purification plant, estimated cost, and method of operation. Bibliography.

Water Wells, Brazil. Dug Wells Lined with Concrete and Tile Solve Amazon Water Supply Problem, J. A. Logan and J. L. Hummel. *Eng. News-Rec.*, vol. 136, no. 24, June 13, 1946, pp. 908–911. Description of well construction developed for water supply of Amazon Valley region of Brazil; one of features of wall is double-wall filter section, and graded filter bed; walls are constructed with perforated hollow tile, casing being strengthened by addition of reinforced concrete rings and columns; chemical and bacteriological examinations revealed excellent quality of water.

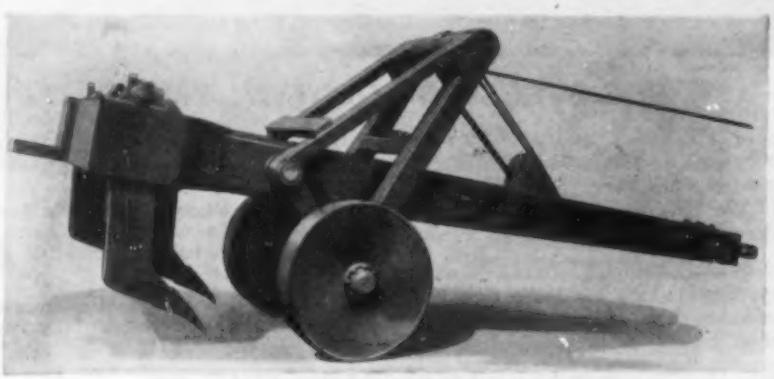
Equipment, Materials and Methods

New Developments of Interest, as Reported by Manufacturers

Caterpillar Rippers

PRODUCTION OF TWO sizes of cable-operated rippers, increasing the company's line of earth-moving equipment, is announced by Caterpillar Tractor Co., Peoria, Ill. Built in two sizes, known as the No. 28 and No. 18, these rippers are rugged machines designed to do the toughest ripper jobs in a way that substantially speeds up scraper loading time and reduces wear and tear on scraper cutting edges and bowls. The No. 28 is built for use with one or two D8 tractors; the No. 18 for use with a single D7 or D8 tractor.

Both model rippers are equipped with three teeth which are detachable in the event less than that number are required on the job. Replaceable tips of the teeth are of heat-treated alloy. While maximum depths of penetration are 28 in. for the No. 18, and 30 in. for the No. 28, accurate control permits the operator to rip material to any depth up to the maximum. The rippers are operated by a rear cable control on the tractor. Sheaves are $9^3/_4$ in. in diameter and eighty feet of $^1/_2$ in. cable is required for operation. Wheels of the rippers are of the steel drum type.



Approximate shipping weights of the No. 28 and No. 18 models are 13,000 and 9,500 lb., respectively. Removable cover plates are provided in the frames to permit filling with sand or other materials which will increase the operating weight of each model approximately 2,200 lb.

New Line of Truck Tires

ANNOUNCEMENT OF A complete new line of truck tires to be known as the Road Lug, designed and developed for combination off-the-road and highway service, has been made by The Goodyear Tire and Rubber Co., Akron, Ohio.

Production of the Road Lug tire in sizes 7.00–20 through 12.00–24 has begun in Goodyear factories and ultimately sizes 13.00–24 and 14.00–24 will be made available, the announcement stated. The Road Lug is particularly suitable for use in such services as logging, quarrying, and strip mining under conditions where heavy loads must be hauled out on rocky, rutty, or stump-obstructed roads to surfaced highways for long hauls to ultimate destination.

The tires are constructed with a rayon cord carcass, tread and sidewalls with natural rubber content equal to prewar tires of same size, extra heavy layers of cushion rubber between plies and extra heavy rayon breaker. All sizes have multiple beads of high-carbon steel wire, the announcement stated.

New Thru-Wall Flashing

ANNOUNCEMENT OF A new and improved thru-wall flashing has been made recently by Chase Brass & Copper Co., Waterbury, Conn., a flashing that embodies six new features which are designed to greatly enhance its waterproofing facilities. These six new features are: saw-tooth corrugations that form a mechanical key bond in the mortar, vertically and laterally; perfect drainage—if moisture should penetrate it will drain quickly; provides for expansion and contraction; interlocking overlap which requires no soldering; stiff counter-flashing face that hugs the wall tightly after the base flashing has been installed; ease with which it may be bent by the sheet metal worker.

Made in sheet form in standard widths up to and including 34 in. wide and 6-ft. lengths, Chase Thru-Wall Flashing is available through all of the twenty Chase Warehouses throughout the country. A folder describing this improved flashing is titled "The New Chase Thru-Wall Copper Flashing."

New Gasoline Engine

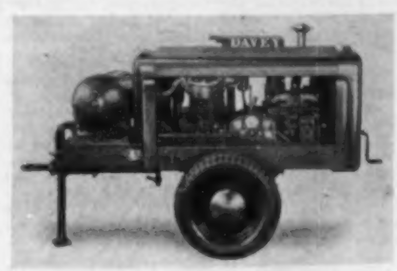
A NEW TYPE of lightweight industrial gasoline engine is now being mass-produced by McCulloch Motors Corp., 6101 W. Century Blvd., Los Angeles 45, Calif.

The engine, Model 1200D, is a single-cylinder, 2-cycle, air-cooled type that weighs 24 lb., and develops a rated 2.5 hp at 2500 rpm. It possesses the advantages of extreme lightweight, small size, simplicity, fast acceleration, low maintenance, easy starting, and smooth idling. The entire engine, with the exception of the forged steel crankshaft and rod and the hardened steel cylinder insert, is built of high-pressure, high-strength aluminum-alloy die castings.

The Model 1200D is a vertical-crankshaft engine, and was designed for such applications as vertical pumps, and other implements requiring a vertical power drive. All bearings are the anti-friction type. The engine is air cooled and has a high-tension flywheel magneto and a rope starter. Bore and stroke are 2×2 in.; displacement is 6.28 cu. in. Overall dimensions, including gas tank and spark plug are: height 14.6; length 17.8; width 14.2.

New Portable Compressor

THE DAVEY COMPRESSOR CO., Kent, Ohio, has just announced a new Model 60V portable compressor for 1947. This new unit is available in standard skid and 2-wheel pneumatic tired trailer mounting styles, also with flanged wheels for railroad work. It is likewise offered (complete with a Davey Heavy Duty Power Take-off) as an "Auto-Air" compressor for truck mounting. The compressor produces



60 cu ft per min at 100 lb. pressure and is designed for heavy duty service. The compressor has one low pressure cylinder with $5^3/_4$-in. bore and $4^1/_2$-in. stroke. The high-pressure cylinder has $3^5/_8$-in. bore. Operating speed is 1,225 rpm. Weight of the 2-wheel model is 2100 lb. Over-all dimensions are: length, 88 in.; width, 62 in. (tire track line, $52^1/_2$ in.); height, $51^1/_2$ in. The compressor (in skid, trailer, and railway models) is powered by a Hercules IXB Engine.

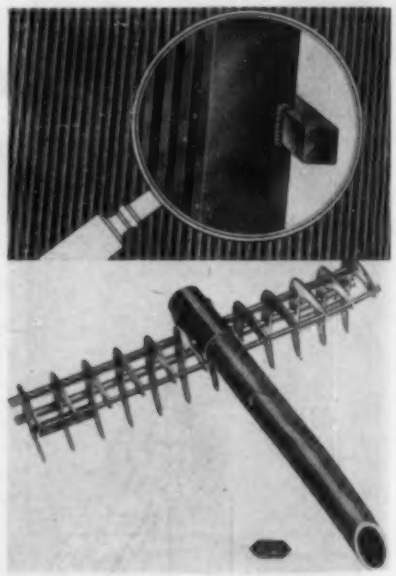
Men-E-Uses Power Drive

A VARIABLE SPEED drive, named, "Men-E-Uses Power Drive," is designed to meet any fractional hp drive requirements. It has a range of from 20 to 750 rpm with 1,725 rpm motors. Can get down to 4 rpm with additional auxiliary shaft. Base and housing of aluminum, for light weight—12 pounds. Adjustable height depending on length of posts used. Has universal motor mounting from $^1/_2$-hp motors, and under. Either direction of shaft rotation can be secured by mounting motor right or left on base. Power drive in no way depends on the direction of the motor rotation. Easily and quickly changed from one piece of equipment to another. Bulletin No. NN from The Flinchbaugh Co., 750 South Court St., York, Pa.

Trash Racks and Rakes

New developments in Trash Racks and Rakes have been announced by the Rodney Hunt Machine Co., Orange, Mass.

The new Rodney Hunt "Power-Saver" Trash Rack has an improved all-welded back bar construction, and is easier to clean. The vertical slats have no holes to weaken them, are spaced exactly to specifications, and are welded into position so they cannot bend or twist, the manufacturer says. The Racks can be quickly installed in sections by tack welding or clipping and bolting the adjoining back bars for a permanent installation which will



not move or vibrate. Heavily covered with a specially developed water-resisting black asphaltum paint, the "power-saver" Rack is protected against corrosion.

According to Rodney Hunt, the new "power-saver" stainless steel Trash Rake is designed and constructed to be as strong and rigid as one piece of steel. Basket-type teeth offer great capacity, strength, and rigidity. The teeth are spaced to engage the slats of the Trash Rack correctly, and double length guards prevent interference between the teeth and the back bar of the Trash Rack. This Rake head has a light tubular handle.

Light and Power Units

Production of four new Da-V-Lite portable lighting and power units has been announced by Davey Compressor Co., Kent, Ohio.

Designed to provide light and power "where and when" it is needed, each Da-V-Lite is built around a 5,000-watt Westinghouse self-excited, self-regulated a-c generator. The latter is driven by a 15 hp, 4-cylinder Wisconsin air-cooled engine, equipped with electric starter. The four standard models, as announced, are (1) Floodlight, (2) Searchlight, (3) Combination, (4) Beacon. All are available in skid and 2-wheel spring trailer mountings. Trailer machines are 9 ft long, 7 ft 6 in. high, and 5 ft wide. Weight is approximately 1750 lb.

Floodlight models are equipped with four heavy-duty Westinghouse 16-in. floodlights, providing 185,000 candlepower per light. Each light is individually operated from the control panel and can be raised to a height of 8 ft 6 in. Searchlight models are suitable for spotting specific restricted areas. They are standard equipped with two Westinghouse 18-in. searchlights furnishing 1,965,000 candlepower per light. Auxiliary transformer equipment is optional to boost the per light candlepower to 3,225,000. Combination models are designed for both "work-lighting" and "spot-lighting." They have two 16-in. floodlights and two 18-in. search lights. Beacon models are for special directional lighting applications. Each unit has one 24-in. Westinghouse 11,280,000 candlepower searchlight. In addition to their lighting uses, all four models can be employed in case of emergency, to supplement existing power facilities or to provide motive power for electric tools.

Expansion Joint Slitter

A new automatic unit for slitting all types of expansion joints is announced by Keystone Asphalt Products Co., Chicago, Ill. The Keystone Expansion Joint Slitter, driven by a 1-hp electric gasoline motor cuts all joint materials up to $1^1/_2$ in. in thickness at the rate of 60 fpm. Forward and reverse operation permits cutting in both directions. The net weight of the unit is 500 lb.

Literature Available

A-C WELDERS—Construction details, electrical specifications and application data on the complete line of A-C transformer type welders are contained in a new booklet (B-3548) by the Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30, Pa. Detailed information is given on the 500- and 400-ampere industrial welders for fast, steady production; the 300-ampere welder for heavier-than-average work; and the general duty welders ranging from 20 to 250-amperes. Electrical specifications and performance data are presented in chart form, and general application information concerning recommended electrodes is also included.

BRIDGES—A new booklet, "Planning Small Bridges with Toncan Iron Drainage Products," contains detailed charts and tables of the dimensions and design properties of Toncan iron section plate and sectional plate arches, and numerous illustrations and descriptions of applications of Toncan products to small bridge design. Toncan Culvert Manufacturers Association, Film Building, East 21st St. and Payne Ave., Cleveland, Ohio.

BUCKET SELECTION—In its new Catalog No. 2076, Blaw-Knox has ingeniously presented its two-line buckets in a manner which makes it easy for a prospective user to make his own selection. A combination of pictures and factual data enables a bucket user to coordinate his crane capacities with the data presented and select exactly the right bucket—whether it be for rehandling, hard digging, or dredging. Catalog 2076 from Blaw-Knox Co., P.O. Box 1198, Pittsburgh, Pa.

CHAIN HOISTS—Chester Hoist Co., Lisbon, Ohio, has issued a new 16-page, $8^1/_2 \times 11$, bulletin covering their complete line of Spur Geared (High Speed) and Differential Chain Hoists, and their Army Type Low Headroom Timken Equipped Trolley Hoists. It also includes tables, section and photographic views of the various products, and a complete line of I-Beam Trolleys.

MORTAR & PLASTER MIXER—A description of the 1947 Rex mortar and plaster mixer is presented in Bulletin No. 46-11. The new bulletin contains close-up illustrations of features of the mixer, such as the adjustable for either truck or car hitch; and the 4-hp, air-cooled engine. Job pictures and a table of specifications are included. Write Chain Belt Co., 1600 West Bruce St., Milwaukee 4, Wis.

MOTOR GRADER—With the resumption of production of the "Caterpillar" Diesel No. 212 Motor Grader, the manufacturer has published a new folder, Form 9730, outlining the construction attributes and operational advantages of this machine. The illustrated folder, which includes basic specification figures, outlines the tandem or single drive faculties of the product, the leaning front wheels, the wide variety of blade positions offered, the extreme positions possible by adjustment, and the attachment, available to users. Caterpillar Tractor Co., Peoria 8, Ill.

Pipe Line Construction—The myriad operations of pipe line construction form the theme of the booklet, Hills, Bends and Crossings, Form 9725, published by Caterpillar Tractor Co., Peoria 8, Ill. Graphically illustrated, this 12-page color booklet highlights the tasks of pipelaying from initial pioneering to backfilling and includes on-the-spot stories of material wasting, furrowing, stringing and stabbing-in, doping and wrapping, cleaning and priming, welding and hauling.

Power—"More Power to U.S.A." is the title of a new 32-page bulletin released by the Allis-Chalmers Mfg. Co., 708, Milwaukee, Wis., which describes and portrays Allis-Chalmers equipment available for power generation and distribution, ranging from steam and hydraulic turbines, turbo generators, engine type generators and condensers and auxiliaries to pumps, water conditioning, motors, motor control, switchgear, circuit breakers, power and distribution transformers and unit substations.

Pressure Vessel Fittings—The Lenape Hydraulic Pressing & Forging Co., Dept. 31, Westchester, Pa., has published a new bulletin 4-61 illustrating the wide range of press-forged welding necks, nozzles, manways, and hand-holes which they produce. Included are all of the standard and many of the typical, special types of connections and openings used in pressure vessel fabrication.

Rubber-tired Tractor—Caterpillar Tractor Co., Peoria 8, Ill., has just published a 12-page booklet which describes its DW10 Tractor, a rubber-tired machine designed and built for heavy, off-road earth-moving operations. Action pictures of this rugged high-speed tractor, model views of the unit and its heavy duty 100 horsepower Diesel engine and brief specifications are included in the catalog. Request Form 9358.

Screen—A new Bulletin No. 111-A describing and illustrating the Robins Eliptex Screen may be secured from Robins Conveyors Inc., Passaic, N.J. The Eliptex employs a unique elliptical motion with three separate components: a horizontal component which moves the material across the deck quickly, giving high capacity; a vertical component which makes the material separate into sizes and "keep moving;" and an elliptical component which gives sharpest possible sizing. Specific applications for dewatering, heavy-media dewatering, and asphalt plants are also defined in detail.

Trucks—A new folder, No. 461, describes and pictures Four-Wheel Drive trucks for heavy-duty service. Typical applications and detailed illustrations of construction features are included. The Four-Wheel Drive Auto Co., Clintonville, Wis.

Utility Tool—The Simplex Util-A-Tool—jack of all trades—pulls, pushes, spreads, bends, clamps, lifts; pulls pinions, bushings, and plain or spoked wheels and gears. The Tool of a Thousand Uses is pictured in many operations and completely described in a new bulletin released by Templeton, Kenly Co., 1020 S. Central Ave., Chicago 44, Ill.

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